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TAXING IMPORTED ELECTRICITY.

A mighty uproar has broken forth upon the banks of the Niagara. It is proposed to generate electricity on the Canadian side of that river, and to sell electric power on the American side. Somebody has raised the question whether such foreign-made electricity is not subject to a duty of ten per cent *ad valorem* as an "unenumerated manufactured article." This question has produced a flood of debate, and while it is purely hypothetical as yet, the Merchants' Exchange of Buffalo has gone so far as to pass a resolution opposing such taxation.

Those who desire discrimination in favor of home-made electricity argue that electric power is a vendable and valuable product of manufacture; that it can be measured easily and accurately, and that foreign-made electricity should pay duty equally with foreign-made cloth or wine.

Those who believe in free trade in electricity point out that it is not an article, that it is not valuable or sold or salable, that it has no power to do work but only serves as a means of transmitting power, and that it is utterly impossible to import it because it instantly returns to its source. Assuming a Canadian plant selling power on the American side of the frontier, absolutely nothing material would be exported or imported. The electricity—whatever that may be—could be justly considered to travel along the line into the United States, and at once to travel back to Canada.

Suppose two pulleys, one on each side of the Niagara River, with a rope or belt connecting them. This arrangement would transmit power if one of the pulleys was turned. Similarly, while it was running there would be a more or less rapid importation of the belt, and an exactly similar exportation. And it could not be said with truth that such an arrangement constitutes an importation of power, for the power, in its applicable form, does not exist in transit, but only at the driven pulley. Now this arrangement is an exact analogue of an electrical power transmission.

If those who are anxious to prevent Canadian importations would only turn their attention to certain unenumerated, unmanufactured products of that country now entering duty-free, such as blizzards, north winds, hunting and fishing stories, etc., they would do a good work.

THE NORTHWESTERN CONVENTION.

The recent meeting of the Northwestern Electrical Association, at Milwaukee, was a repetition of the highly interesting and successful conventions that have marked the history of this active body. There is a sort of energy about the citizen of our Northwestern states that is typical of him and his country, and is exhibited in his undertakings. This activity is always manifest at the Northwestern Associations gatherings; business is transacted swiftly, papers are discussed with interest, and everybody joins in the effort to make the occasion "move" and to have a good time. This year the attendance was good, the interest in the proceedings as great as ever, and the "good times" almost continuous.

There is no feature of the regular work of electrical companies more interesting or more characteristic than these gatherings. They have been of untold benefit to the electrical industry. The Northwestern Association is to be congratulated upon the real value of its work and the benefits it has wrought for its members.

IS THE SUPPLY OF ELECTRICITY EXHAUSTIBLE?

One would think that in these days of stirring events, newspapers could find enough subject matter without raising such a question as that which heads this paragraph. It has been raised, though, in all seriousness, and in Ohio and adjacent regions its discussion at present

waxes voluminous. The Cincinnati *Commercial Tribune* views with alarm the dependence of civilization in general upon electricity because, since nobody knows exactly what it is, the supply may be limited and some day we may come to the end of it. The thought is dreadful, but amid the gloom one bright prospect cheers us, and that is that it is not being used up at all. Furthermore there is no such thing as electricity anyway.

The editor of our esteemed Cincinnati contemporary is arguing from a totally erroneous, but nevertheless generally popular point of view. For convenience of expression the word electricity has been used as if it were the name of a veritable entity. In fact, there is no such *thing* as electricity; it is a ***condition.***

To define this condition of matter and ether that is commonly called "electricity" is not yet perfectly possible, though the true nature of electricity is far better understood than that of so simple and everyday a phenomenon as gravity. We know enough about it to say that electricity is certainly not a substance, and, for the present, perhaps it is safer to let our definite assertions stop with the statement that it is a state into which a body and its surroundings may be brought by suitable work done upon it. That is all. Hence we are in no particular danger of seeing our stations crumbling into picturesque decay, and our telephones on the scrap heap. Indeed, if all the electricity were gone, we wouldn't see anything, because there would be no more light.

NEWSPAPER SCIENCE.

Once in a while a newspaper stirs in a little technical matter as a flavoring to the daily hodge-podge, but it is not always sure to get the right brand. To those in search of scientific information the following extract from the esteemed Elmira *News* may be of interest:

"The storage building of the Edison electric plant, New York city, took fire by the explosion of the transformer, which released a stream of electricity into the air of 6,000 volts. Before the fireman could get hose in action, Harry Pond, the chief electrician, managed to crawl out of the building and warn them. Had the electricity been spread by the streams of water there is no estimating the loss of life. The firemen, therefore, were compelled to be silent witnesses of the blazing building."

What a frightful catastrophe! Imagine the dangerous transformer detonating with violence, the pale blue streams of electricity and, above all, the "air of 6,000 volts." This latter surrounds the occurrence with such an atmosphere of horror that we forbear to enlarge further upon the harrowing details.

The Value of Patents in Business.

To the Editor of Electrical Review:

During a recent conversation with a prominent financier, who has been largely identified with the formation of many of the great trusts, I asked him: "What value do you place upon patents?" He replied: "I look upon patents as a useful but non-essential adjunct of a business. I recognize that it is good business policy to acquire all the patents possible. But any trust which depends upon patent protection for an advantage over its competitors in business will prove a failure. A trust to be successful must obtain its success wholly from the exercise of intelligent business methods; that is, the business in which it is engaged must possess attributes which would make it successful if it were entirely free from patent protection. Patent protection may, or may not, add to the profits of a trust, depending entirely upon the intelligence with which its patent property is handled.

"I am inclined," he continued, "to disapprove of promiscuous patent litigation which is more apt to prove injurious than beneficial. You will admit that the Standard Oil Company, American Sugar Refining Company, as well as other similar trusts, have been well managed, and yet the amount of patent litigation in which these concerns have been engaged is so trivial as to amount to nothing. On the other hand, the electric trusts have been in constant litigation and have spent millions of money, and I have yet to see that they have in anywise succeeded in controlling the electric industry or added to their profits.

"Patents," he said, "I look upon as scarecrows, which can be well planted around a field of industry for the purpose of scaring off the public crows, which otherwise would be apt to attempt to gather the grain which we had sowed. But, however useful patents may prove as scarecrows, I do not consider them either as a safe basis for an industry or good weapons in an industrial war.

"I do not wish to be understood," he explained, "as disapproving of patents. The principle of securing to an inventor the control of his invention, for a limited time, I consider as beneficial to the interests of the country and should be encouraged; and I think it the duty of every manufacturer to do what he can for the encouragement of invention. The whole trouble with patents may be summed up in a few words: A patent neither protects the inventor or its owner. The fault lies between the Patent Office and the courts. The Patent Office issues patents for any old thing, entirely irrespective of whether it possesses the quality of invention or not. Anything may be patented so long as it is new. The courts look upon an inventor or the owner of a patent as something between a buncosteerer and a wild beast, to be destroyed on sight, or to be so confined by judicial interpretation as to be harmless. If patent protection protected, patents would be valuable. But it does not. If patents were protected by the courts they would be of the utmost value to any honestly conducted industry. In point of fact, the present practice of the United States courts is utterly discouraging to inventors and owners of patents, rich or poor.

"Theoretically, a patent is *prima facie* valid, and courts undertake to use their power to sustain the right covered by the grant of the patent.

"Practically, the courts aid unscrupulous infringers to destroy the patent by permitting a system of practice to exist which is ruinous to the patentee. Weeks and months of extended cross-examination, huge printing bills, expert's fees, etc., soon use up what Bismarck called 'the fighting capacity' of patentee or owner.

"There is no good reason for this condition; the question of infringement is usually a very simple one and could, as is the English and Canadian practice, be settled by a few days in court, and at a very small percentage of the present cost.

"The present practice is apparently in favor of corporations and capitalists. I say apparently, for it is more imaginary than real; and by that I mean: Any system of practice which permits an unfair advantage in favor of either litigant is sure, sooner or later, to breed evils. Corporation managers who have neglected good business methods to destroy their rivals by costly patent suits have found this out to their cost."

The above statement from a cool-headed business man, not afflicted by "patent mania," should be thoughtfully considered by every one who desires to maintain the permanency of the patent system which has done so much to promote the material prosperity of the country. It is not the patent system which is to blame, but the very faulty administration of the system.

George H. Benjamin.

New York, January 20, 1900.

A TYPICAL MODERN ELECTRIC LIGHTING CENTRAL STATION.

THE NEW STATION OF THE PHILADELPHIA ELECTRIC COMPANY—A HIGH-TENSION GENERATING PLANT OF DISTINCTLY MODERN DESIGN.

The history of the numerous electric lighting corporations in Philadelphia, has been similar to that of the electric railway companies in the same city. Through gradual consolidation and processes of reorganization the whole of the electric lighting interests of that city have been brought under the management of one concern, called the Philadelphia Electric Company, which now controls the entire business of electrical distribution for lighting and power purposes in the city and its suburbs, excepting one small station.

The station to be described below is one which unites with many features of merit in its design, additional interest on account of its having been remodeled from a former electric railway station, making it a more difficult and tedious piece of work than an entirely new construction would have been.

At the foot of Callowhill street, on the west side of the city of Philadelphia proper, and facing the Schuylkill River, is a brick building which was formerly the generating station of the Hestonville, Mantua & Fairmount Park Street Railway Company. Through the various processes of consolidation mentioned above this property fell by lease into the control of the electric lighting corporation, and has been changed over to a lighting station of the most modern description.

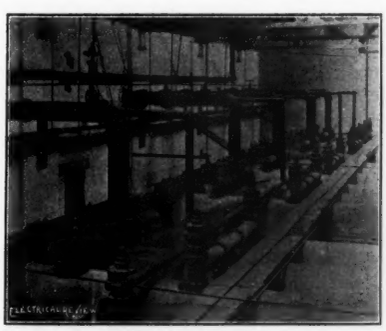


FIG. 2.—TOPS OF BOILERS SHOWING PIPING—PHILADELPHIA ELECTRIC COMPANY'S PLANT.

In the old station there were four engines of a tandem compound type, each driving a 500-kilowatt direct-current railway generator. The general ground-plan of the establishment consisted of one large, rectangular room, 65 feet by 160 feet, in which were installed the engines and generators, and a similar room, 48 feet by 160 feet, separated from it by a thick fire-wall, in which were placed the boilers. In attempting to utilize the old station for electric lighting purposes it was found possible to double its output by the use of improved apparatus of larger capacity.

The old outfit of six boilers was removed. These were originally of a water-tube pattern, 250 horse-power each, at 125 pounds pressure, and gave a total output of something less than 2,000 horse-power. In their place were erected four batteries of double-deck water-tube boilers, built by Messrs. Aultman & Taylor, of Mansfield, Ohio, all constructed to carry steam of 165 pounds pressure, and tested after erecting to 275 pounds. Of these boilers, six have a capacity of 500 horse-power each, while two are of 410 horse-power each, this difference being to accommodate the batteries more easily within the space at disposal and to permit of certain passageways which will be described below. This rating of the new boilers is based on 11.1 square feet of heating surface and an evaporation of 30 pounds per horse-power, leaving still a margin of 30 per cent reserve capacity, and being all the capacity possible to erect within the space. Twenty-four furnaces feed the boilers and are fired by hand with No. 1 Buckwheat coal. This fuel, which is one of the best steam-raising fuels known and requires little attention in its handling, is delivered on the Schuylkill River in barges moored to the wharf, or in emergency it may be delivered in carts from the nearby railway. A coal conveyor of the link-belt type lifts the coal from the boats into an elevated receptacle, from which it is conveyed to the bunker of 1,200-tons capacity, and then may be discharged by gravity to the fire-room into charging-cars, each holding 1,000 pounds when filled level. These are wheeled in front of the furnaces and the firemen handle the fuel by hand from them. This method is simple and economical in manipulation, and accurate for purposes of daily records of fuel burned.

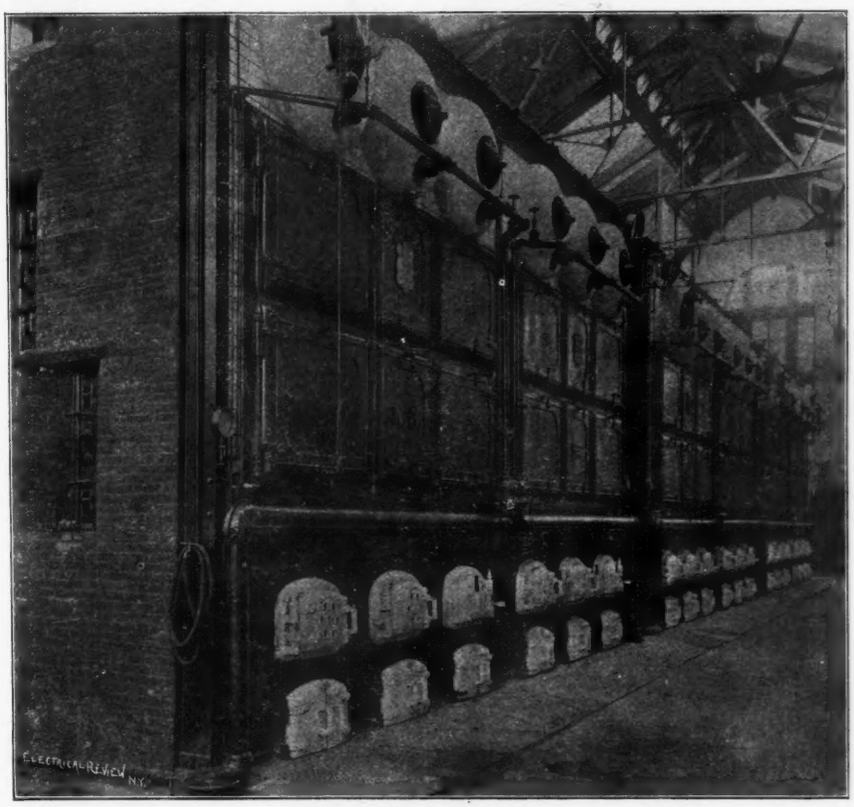


FIG. 1.—FRONTS OF BOILERS—PHILADELPHIA ELECTRIC COMPANY'S PLANT.

Among the appurtenances of the power station in its original form was a brick stack, rated at 3,000 horse-power and of square section; this has been utilized in the new installation. A brick smoke-flue is built the entire length in rear of the boilers, and by gradual taper enlarges to full area where it connects with the base of the stack. At each end of the boiler-room is a nine-foot centrifugal fan, built by the Buffalo Forge Company, of Buffalo, N. Y., and driven by a direct-coupled steam engine of the same manufacture. These are connected with a brick air-flue built under the pavement parallel with the boiler fronts. Branch air-ducts to each ash-pit controlled by dampers under each of the furnaces allow an extra blast from this reservoir of air under pressure, and thus permits the steam-raising capacity of the

FIG. 3.—INTERIOR OF PUMP ROOM, SHOWING COMBINED AIR AND CIRCULATING PUMPS AND INTAKE AIR-CHAMBER—PHILADELPHIA ELECTRIC COMPANY'S PLANT.

boilers to be greatly enlarged by the use of forced draft, only necessary under extreme peak load conditions.

In Fig. 1 is shown the fronts of the boilers, while Fig. 2 shows the tops of the bank of boilers, with the very simple steam piping arrangement.

A pump house is erected at the river end of the station in which are located the feed water heaters, boiler feed pumps, and combined air and circulating pumps for the condensing system.

The method of feeding the boilers is by Worthington duplex steam pumps with outside packed plungers, which maintain a steady pressure by automatic regulation in a system of feed-water piping which may be opened into any boiler through an appropriate valve. These pumps take the water from Cochran heaters and purifiers, built by the Harrison Boiler Works, of Philadelphia, which are rated at a capacity of 5,000 total horse-power, the heater units being two in number, one of 2,000 and one of 3,000 horse-power, purposely selected of large size to give the water ample time to purify and heat up.

Fig. 3 shows the interior of a portion of the pump house in which are also installed the Blake combined circulating and air pumps for the condenser system. These are four-cylinder tandem pumps, having the compound steam cylinders centrally located between the air-pump cylinder at one end and the circulating pump cylinder at the other. The capacity of each pump at the normal rate of speed, 50 strokes per minute, is 3,300 gallons of circulating water per minute. This water is drawn from the river directly through a 24-inch suction pipe fitted with a strainer and check valve. Air

FIG. 4.—CRANK PLATE AND FLYWHEEL OF ONE OF THE GENERATING SETS—PHILADELPHIA ELECTRIC COMPANY'S PLANT.

chambers are installed on both the intake and delivery sides of the pump piping, which is very substantial in every detail. The general system of water circulation is unusually ingenious and is designed to save, as far as may be possible, any waste of thermal energy in the plant. The surface condensers, which are of the Wheeler type, are installed in the basement between the foundations of each pair of engines and the cold circulating water flows through a cast-iron pipe, reduced in diameter as it passes the delivery connection, to each condenser. Passing around the tubes of these surface condensers the circulating discharge, under proper adjustment of flow, is raised to a temperature of from 110 degrees to 112 degrees Fahrenheit. At each condenser, where the circulating water enters its discharge pipe, is arranged a by-pass with a controlling valve shunting a portion of the heated water into a system of return feed piping conveying this warmed water to the heaters for boiler feed purposes. In these the steam from all the steam auxiliaries in the station raises its temperature to a little above 200 degrees, at which it is pumped by the other pumps described above into the boilers.

The water from the condensed steam of the engine exhaust is discharged through a separate pipe direct to the air-pump cylinders, and has no chance to mix the oil from the cylinders with the boiler-feed water.

This arrangement makes it unnecessary to have any intermediate heater between the engine exhaust and the condenser, as the cooling surface of the condenser acts in this capacity and the waste heat of the engine exhaust performs its func-

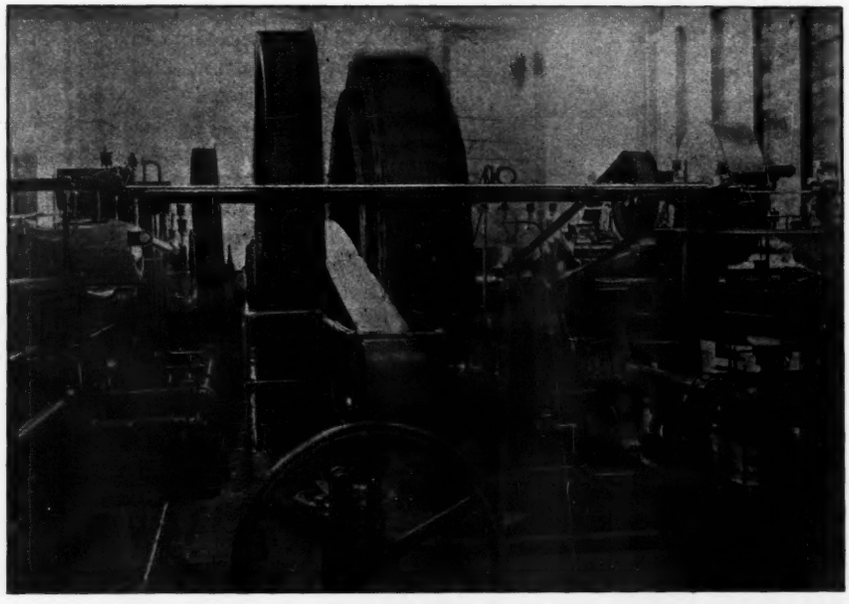


FIG. 5.—VIEW OF GENERATOR FROM BETWEEN TWIN ENGINES, SHOWING FLYWHEEL, EXCITER AND GOVERNOR—PHILADELPHIA ELECTRIC COMPANY'S PLANT.

tion of heating the water used as boiler feed up to 110 degrees Fahrenheit. This water on reaching, through its separate pipe, the heaters and purifiers, is met by

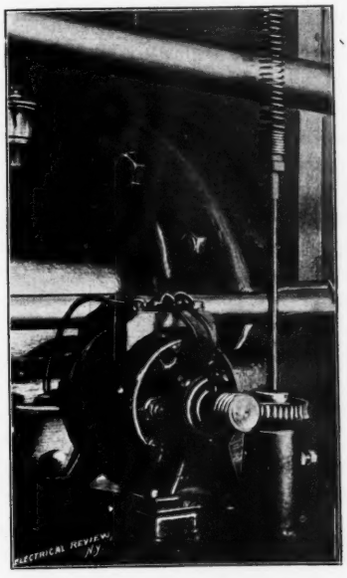


FIG. 6. — GOVERNOR REGULATING MOTOR— PHILADELPHIA ELECTRIC COMPANY'S PLANT.

the exhaust from the pumps and live steam drips, and is readily heated to a temperature of from 190 degrees to 200 degrees Fahrenheit.

The following results from the condenser system are quite as good as are usually obtained, *viz.:*

Vacuum 27, 27½ and 28 inches, tested by standard gauge *connected close into the exhaust at the low pressure cylinders.*

Circulating water, 38 degrees to 40 degrees Fahrenheit as it enters the condenser, and 110 degrees to 112 degrees on its discharge from the condenser.

Accurate and careful work by the engineer in charge will secure the above results, while careless work will reduce the vacuum to 22 or 24 inches and raise the temperature of the discharge to 140 degrees Fahrenheit.

In the work of altering the station from a street railway generating plant to its present condition the space allowed between the original engines made it possible to double the engine capacity. In the original station, as has been mentioned above, there were four engine units, each of which was a left-handed tandem compound. It was found possible to erect between these engines other engines of exactly similar style, though right-handed, and to connect one of each type to a new and larger shaft, allowing a large generator and fly-wheel to be mounted between each pair. In the original installation each engine was set upon a foundation of brick and rubble stone masonary reaching down to piles driven to bed rock. In instaling the new engines the adjacent sides of these foundations were opened down to a depth, in some instances, of 15 feet and were channeled to receive a grillage of steel I-beams, 15 inches by 85 pounds, which run from foundation to foundation, being let into each and set at two feet centres. Over these was filled in a solid stratum of concrete to the level of basement floor, and on this was built up the new brick foundation, a companion to the original, so that, in effect, the present eight-engine units are therefore four pairs of twin-tandem compound condensing engines resting upon a solid monolith of concrete about 55 feet wide by 130 feet long and 16 feet thick.

FIG. 7. — PARTIAL VIEW OF UNFINISHED SWITCHBOARD — PHILADELPHIA ELECTRIC COMPANY'S PLANT.

Two of the engines of the original plant were 17½-inch and 33-inch diameter by 48-inch stroke, of the Greene type, and were built by the Providence Engine Works. Two of the new engines are of precisely similar construction and by the same makers. Two newer pairs are being erected by the Pennsylvania Iron Works. In the old plant the governors were of the usual pattern, but in the new installation a single Rites governor is mounted for each pair of Greene engines. The general arrangement of a pair of engines with the heavy 18-foot 40-ton fly-wheel and generator on the common shaft between the two is well shown in Fig 5.

The governors on the Greene engine are of a combination centrifugal and inertia type specially designed by Mr. Rites for this plant and arranged by mounting on an intermediate shaft so that a single governor controls a pair of engines. In bringing a generator into parallelism with the others it is, of course, necessary to have its speed precisely synchronous with those in operation, and to attain this end a most ingenious and beautiful device is adopted, designed by Mr. Rites of the Providence Engineering Works. A small electric motor, shown in Fig. 6, carries on its shaft a worm-wheel engaging in a counter gear cut on the surface of a nut which runs upon a rod attached to a tension spring connected with a lever from the governor. This motor may be stopped, started or reversed from the main switchboard, in this way altering by a fraction of a per cent the speed of the generating set until synchronism is established.

FIG. 8.—VIEW OF PORTION OF GALLERY SWITCHBOARD, SHOWING HAND-WHEELS FOR CONTROLLING OIL SWITCHES ON FLOOR BELOW— PHILADELPHIA ELECTRIC COMPANY'S PLANT.

The generators are of the standard

stationary armature revolving field type, and deliver two-phase currents, at 91 amperes in each phase, under a pressure of 5,500 volts at 60 cycles per second. Their speed is 100 revolutions per minute. They are of the well-known General Electric type and their construction presents the usual features of this class. The exciting current is led to the revolving fields through collector rings, one exciter being installed for each unit. This machine, as Fig. 5 shows, is belted directly to a pulley on the shaft between the pulley and the generator, the exciter thus derives its power from the most economical source. In one corner of the main engine room, however, is installed a direct-coupled exciter set, consisting of an Armington & Sims engine and 50-kilowatt Siemens & Halske generator, capable of taking care of several of the generators forming the station equipment, so that any delay or suspension of operation due to an exciter breakdown is well guarded against.

In the basement under the engine room is installed the shower baths, basins, water-closets and employee's lockers, also all the system of piping, both for exhaust steam, circulating water, oil, air-pumps and the other auxiliaries described above, as well as the condensers. Here, also, between two of the foundations, is located a fire-proof store room. The whole building is as nearly as possible fire-proof, the floor, formerly of wood, now being constructed of brick and concrete arches supported by steel beams and finished with granolithic flooring. The leads from the dynamos carry into the basement, where they are led through individual ducts of McRoy vitrified conduits to the cable vault, which is situated below the engine room floor and directly under the electrical gallery at front end of the building. Fig. 7 shows the switchboard as viewed from the engine room floor, while in Fig. 8 is given a view of the face of the gallery portion of the switchboard viewed from one end of the gallery. The peculiarity about this board is that all the high-tension current is handled from the gallery, though none of it is led to that elevation. Under the switchboard, in the basement, is installed the battery of transformers which supply low-pressure current for the various indicating and recording instruments, etc., above, and on the engine room floor are enclosed oil bath switches handling the main current and operated through wooden shafts 15 feet long by hand-wheels from the gallery above. On the main floor are four generators and nine feeder panels constructed of 1½-inch Vermont marble polished both sides and mounted on a structural iron frame.

On each panel, in addition to automatic circuit-breakers, are time-limit relays, set to operate at three seconds. By the use of these appliances a short-circuit does not cause the instantaneous opening of the main circuit breakers and of the line, it being necessary that the over-load should continue for at least three seconds before the circuit-breakers will give way and open the circuit. Through the use of two sets of 5,500-volt busbars and three-pole double-throw oil switches, practically any necessary combination of dynamo and circuits is possible. On the upper section of the switchboard, in the gallery, there is installed a panel for each dynamo and each outgoing feeder, on the latter being placed, in each phase, recording wattmeters, indicating wattmeters and indicating ammeters. In addition to these there is an elaborate and complete outfit of registering and recording instruments for the exciter circuits and generators. General Electric instruments are used. On the main engine room floor a small local switchboard takes care of the interior lighting of the station.

This station has a capacity of 4,000 kilowatts and 6,000 horse-power when fully completed and it is especially noteworthy that no part of its output is directly used for lighting and that all of it is sent out underground. Following the custom of many modern installations on so large a scale, all the current generated in this station is subsequently transformed or converted at other centres for lighting and power purposes. The selection of two-phase distribution was due mainly to the existence of this system in large proportions in the absorbed companies.

This station is, by tie-lines reaching in various directions through the city of Philadelphia, interconnected by an elaborate system of underground work with all the others of the system, so that a suspension of current supply in any part of the city is practically an impossibility. There is also a tie-line connection to a large station located on the Delaware River at Tacony.

The credit for the reconstruction of the old railway station, and the building upon it as a skeleton of a highly modern lighting station of nearly double its output, is due to the skill of Mr. J. H. Vail, the chief engineer of construction of the Philadelphia Electric Company. Mr. W. F. Miller, a practical mechanic, has been foreman of the work.

This station represents one of the most compact, simple and economical designs for such a plant that has yet been installed, and is typical, in regard both to its steam and electrical features, of the most approved modern American practice in central station construction.

The best results from stations of this type can only be obtained, however, where they are in charge of skilled operating engineers.

The Southwestern Gas, Electric Light and Street Railway Association.

At a recent meeting of the Executive Committee of the Southwestern Gas, Electric Light and Street Railway Association it was decided to hold the annual meeting of the association at Waco, Tex., on April 18, 19 and 20, 1900. Messrs. W. S. Rathell, C. W. Hobson and T. H. Stuart were appointed as a committee on arrangements and entertainment.

The programme for the annual meeting includes the following papers: "Electrolysis," by E. H. Jenkins; "Meters and Lamps," by W. S. Rathell; "Operation of Corporations from a Business Standpoint," by A. E. Judge; "Electricity *versus* Gas for Lighting Purposes," by J. F. Cullinane; "Use and Care of Electric Meters," by E. D. Kelly; "Street Railways of Texas from a Historical Standpoint," by F. E. Scovill; "Operation and Maintenance of Street Railways," by H. F. McGregor; "The Attitude of Municipal Corporations to the Public," by J. F. Strickland.

Fire in the Jefferson Physical Laboratory of Harvard University.

A few days ago it was announced in the daily press that a serious fire had occurred in the Jefferson Physical Laboratory of Harvard University, injuring the great condenser and battery of that institution. The ELECTRICAL REVIEW is pleased to state that the damage was much exaggerated. Professor John Trowbridge writes as follows: "I am happy to say that the apparatus was not injured. The fire was caused by the short-circuiting of a transformer and was confined to one room."

American Institute of Electrical Engineers.

The 139th meeting will be held at 12 West Thirty-first street, New York city, Wednesday, January 24, at 8 P. M. A paper will be presented by Charles P. Steinmetz, of Schenectady, entitled "Notes on Single-Phase Induction Motors and the Self-Starting Condenser Motor." A paper will also be presented by Fitzhugh Townsend, of New York city, on "A New Method of Tracing Alternating-Current Curves."

Illinois Society of Engineers and Surveyors.

The fifteenth annual meeting of the Illinois Society of Engineers and Surveyors will be held at Moline, Ill., on January 24, 25 and 26. The programme of papers includes one by Daniel W. Mead, entitled "Some Notes on Electric Light and Power Distribution," and another by Louis E. Fischer on "Municipal Ownership of Combined Electric Light and Waterworks Plants."

MILWAUKEE MEETING.

The Eighth Annual Convention of the Northwestern Electrical Association.

A SUCCESSFUL AND PLEASANT MEETING OF THIS ENTHUSIASTIC ASSOCIATION OF ELECTRICAL MEN.

The eighth annual convention of the Northwestern Electrical Association was held at the Hotel Pfister in Milwaukee, Wis , January 17, 18 and 19. The attendance was gratifying both in point of numbers and the interest displayed by the members. About fifty went from Chicago on a special train.

The quality of the papers presented was high and the discussions were spirited. The usual good fellowship which marks the meetings of this association was in evidence. A notable feature was the prosperous and hopeful atmosphere surrounding the numerous representatives of manufacturing concerns present. All of them reported an unusually successful year, many having doubled and even tripled their output of product.

The social features and entertainments incidental to the convention were very enjoyable, and proved more than ordinarily successful.

WEDNESDAY, JANUARY 17.

The meeting was called to order at noon by the president, Mr. Henry L. Doherty. After approving the programme and accepting the minutes of the last convention as printed, the report of the committee on by-laws was presented by its chairman, Professor D. C. Jackson. The amendments proposed, which were of a formal nature, concerned membership, the place and date of the annual meeting, the order of business, and the status and methods of election of honorary members.

A long discussion resulted, and the further consideration of the by-laws was postponed until a later hour.

President Henry L. Doherty then read his presidential address, which dealt with questions of central station economies, the progress of the electrical business, anticipated improvements and developments in it, accounting, and especially with the question of municipal ownership. An abstract of President Doherty's address appears on another page.

In the discussion, in which Messrs. Copeland, Bean, Jenkins, Livermore and Debell took part, the remarks of the president concerning municipal lighting plants were made the occasion for reading some newspaper clippings concerning the alleged savings and earnings of such institution. Some of these occasioned much laughter. After a somewhat hilarious enjoyment of these clippings the meeting adjourned until 2.30 P. M.

At the afternoon session the first order of business was the reading and acceptance of the report of the secretary-treasurer, Mr. Thos. R. Mercein.

A committee of two was appointed to draft proper resolutions concerning deaths in the association. Upon motion, a committee of five was appointed to report upon the matter of a Summer meeting.

The report of the protective committee was then read by its chairman, Mr. P. Norcross. This committee has in hand matters relating to taxation, etc., and has appeared before the Wisconsin Legislature several times in the interests of the lighting companies of the state, but with little effect.

A long discussion, or rather a general talk, ensued, and the question of taxation was thoroughly ventilated by Messrs. Norcross, Bean, Copeland, Kountz, Debell, Strong and others. At its close a motion to appoint a committee on taxation was unanimously carried. Messrs. Debell, Hammond, Livermore, Pearce and Frund were appointed.

A number of applications for membership were then read, and all were admitted to membership, as follows:

January 17, 1900, associate, Jos. M. Brooks, salesman, Monadnock Building, Chicago; January 17, 1900, associate, Sangamo Electric Company, manufacturers, Springfield, Ill.; January 17, 1900, E. Kuhlman, manufacturer, Elkhart, Ind.; January 17, 1900, A. M. Barron, manager Home Electric Light and Power Company, Elkhart, Ind.; January 17, 1900, active, Red Wing Gas and Electric Company, secretary, Red Wing, Minn.; 1899, Ernest H. Davis, Lycoming Electric Company, Williamsport, Pa., active; May 25, 1899, Varney & McCuat, electric supplies, 125 South Meridian street, Indianapolis, Ind.; New York, May 24, 1899, associate, F. S. Terry, vice-president Sunbeam Incandescent Lamp Company, 242 South Jefferson street, Chicago; New York, May 22, 1899, M. E. Baird, manager sales department, Eddy Electric Manufacturing Company, Marquette Building, Chicago, Ill.; New York, May 23, 1899, associate, Chicago Insulated Wire Company, manufacturers, 152 Lake street, Chicago; August 21, 1899, S. T. Carnes, president Memphis Light and Power Company, Memphis, Tenn.

A paper entitled "Modern Development in Alternating-Current Series Arc Lamps" was then read by Mr. R. Fleming, of Lynn, Mass. This paper appears on another page of this issue.

A long and interesting discussion followed. Mr. Allen, of Faribault, Minn., described experiments on a commercial circuit in which he had found series alternating-current arc lighting very satisfactory. His company's customers are better pleased with these lamps than they were with the old open lamps.

Mr. Fleming said he thought it would be entirely feasible to put constant-current transformers underground.

The president said that two central stations in St. Louis had been supplying street incandescent lights for a long time, using constant-current transformers regulated by hand.

Mr. Wurdack, of St. Louis, described one of these installations. He said:

"We have somewhere in the neighborhood of 3,000 32-candle-power, five-ampere lamps installed on series transformers, and we regulate them by hand. We have found by experience, however, that no regulation in particular is required. We have put 300 lamps on a circuit and very seldom more than one or two lamps burn out, or are broken in one night. Occasionally we have a short-circuit, or a cyclone, or something that causes trouble, but we have circuit-breakers on our transformers with a relay attachment that works within about five per cent, and when the current runs up the circuit-breaker goes out. But they probably do not look at it ordinarily once a night, and yet we get a very high efficiency—that is, we get about 95 to 96 per cent on our series system. We use Bernstein lamps, or United Electric Improvement Company's lamps. They last so long that we hardly take the trouble to figure out the expense of them. We have a great number on our circuit that have been there 10,000 hours, and some of you would think they would hardly be bright enough to find. But that is not the case. The series lamp will maintain its candle-power surprisingly long. Our lamps have some of them been on 10,000 hours and they were installed probably at 32 to 34 candle-power, and will now run probably 25 candle-power, and some will run as low as 20. But very few run under 20 candle-power. They do not depreciate very much in candle-power, because the resistance of the carbon increases and so brightens up the lamp. I think the only effect of poor light is that the lamp darkens a little bit after being up about 2,000 hours. We average about 4,000 to 5,000 on the series circuit. Some of the lamps, however, have been up 18,000 hours, where we have left them up for experimental purposes. We find it is a very efficient system in spite of the fact that many electricians think we are back numbers for running them. I believe the day will come when, in residence districts, the series incandescent lamps will be installed. It may happen in St. Louis yet, I don't know. We are thoroughly satisfied with our series incandescent lamp system, and it is perfectly satisfactory in every way with the hand regulation, because with 300 or 400 lamps on a circuit, while it runs the voltage up pretty high, we have the advantage that, if half a dozen lamps were broken, it would make very little difference with the lamp.

"We have two kinds of cutouts on our lamps, one an ordinary Thomson-Houston

film cutout, in which, when the lamp burns out, the current crosses the paper film and goes on, and another is a shunt coil in series with paper film, so that while the lamp is burning no current passes over the shunt coil, and on those circuits if all the lamps should burn out on one circuit of course it would not affect the regulation. The shunt coil is made to take exactly the voltage the lamp does. For instance, if a lamp takes 20 volts, and one burns out, the shunt coil uses 20 volts. That system is perfect in regulation. You can burn out 300 lamps and your ammeter would not move. We have put up one circuit for experiment and found it very satisfactory."

Mr. Frund bore out Mr. Wurdack's statements, and cited his own experience.

Mr. Fleming called attention to a similar installation at Woburn, Mass., which, he said, was giving great satisfaction.

The discussion at this point grew general, many questions showing the interest of members in this type of street lighting being asked. It finally went into the subject of light and illumination.

The discussion being closed, letters were read from Mr. G. L. Thayer and the Edward P. Allis Company, the latter extending an invitation to the association to visit its works in Milwaukee.

Professor D. C. Jackson then read his paper entitled "Fundamental Ideas of Alternating Currents."

A discussion, which was rather a commendation of this valuable paper, closed the meeting. Mr. A. S. Ford offered to print, at his own expense, 15,000 or 20,000 copies of the paper, and the offer was accepted by the association.

The meeting then adjourned until the next morning.

THURSDAY, JANUARY 18.

The Convention was called to order by the president and, Mr. W. H. Schott, of Chicago, read a paper entitled "Central Station Heating in Connection with Electric Lighting Plants." It will be found, in full, on another page of this issue.

A long discussion ensued, Messrs. Korst, Frund, Copeland, Stahl, Doherty, Bean, Livermore, Fleming Schott, and the president taking part. It was evident that the association was deeply interested in the question of a market for exhaust steam, and several members related their experience in supplying heat and hot water to customers.

Mr. H. W. Frund then read his paper entitled "Central Station Economies." The secretary then read letters from the Mayor and Citizens' League of Milwaukee, also a number of applications for membership. The discussion of Mr. Frund's paper was then taken up. Messrs. Debell, Jackson, Bean, Doherty, Copeland and others taking part. Mr. Ralph D. Mershon then read a paper on "The Induction Motor," after which the session adjourned until 2 P. M.

The first business at the afternoon session was the election of officers. The result was as follows: President, Pliny Norcross, Janesville, Wis.; 1st vice-president, H. W. Frund, Vincennes, Ind.; 2d vice-president, H. J. Gille, St. Paul, Minn.; secretary and treasurer, Thomas R. Mercein; directors, W. H. Schott, George D. Westover and Mr. Imass. The incoming officers made the usual felicitous remarks upon their induction into office.

The decision to meet next Summer sometime after August 20, at Waupaca, Wis., was reached after a long discussion, in which the merits of numerous cities were presented by members resident in them.

The discussion of Mr. Mershon's paper was then taken up, Messrs. Allen, Jackson, Almert, Innes, Wurdact, Retillac, and others participating.

Following this the discussion of the by-laws was resumed, and the report of the by-laws committee adopted.

Professor Richter, of the University of Wisconsin, then read a paper entitled "Relative Desirability of Various Types of Engines on Central Station Loads." The discussion following this was general.

In the absence of Professor George D. Shepardson, Mr. Marsh read his paper upon "A Life Test of Incandescent Lamps," and adjournment was taken until the next day.

On Friday morning the association met and, finding no work before it, adjourned.

THE PRESENT STATUS OF THE CENTRAL STATION IN THE UNITED STATES.

EXTRACTS FROM THE PRESIDENTIAL ADDRESS, BEFORE THE NORTHWESTERN ELECTRICAL ASSOCIATION.

BY HENRY L. DOHERTY.

The year just closed has been one of remarkable activity and prosperity, and even under the most adverse conditions, the resultant benefits can not be entirely dissipated for some time to come. The central station business is dependent on the general prosperity of the community, although both good and bad results seem to lag behind prosperity and adversity in other channels. Average reports indicate a great increase in income, but also a marked increase in cost of materials; but the increased business gained at this time will continue with us, even after the market for materials has again reached its equilibrium.

A semi-public corporation is more greatly influenced than other industries by the welfare of the masses. Imagine the effect on your business if every workable person had steady employment at good wages. By good wages, I mean a sufficient amount to enable them to have a comfortable home, with modern conveniences. Sooner or later all will recognize that a high standard of wages is the only road to universal prosperity. High wages will not result from strikes, only so far as popular opinion will carry them; and I know of no quicker way to enlist popular opinion against the working class than by the so-called successful strikes. Proper expressions from the press, platform and pulpit, creating a universal interest in a higher standard of wages, thus inspiring the employers of labor to a pride in the condition of their employees, would do more to bring about this desired result than anything else I can imagine.

The progress made in steam and electrical appliances has been all that could be reasonably expected, even though not all that might be desired. The most substantial progress in all lines has been towards the improvement of former developments by the lessons of experience and better mechanical work. The steam turbine has been Americanized and bids fair to supersede, in a great measure, our present engines. Experimental work has indicated a marked economy of steam consumption with other desirable advantages. American-built, high-speed engines, capable of being directly coupled to arc dynamos, are in successful operation, and steam economy equals most modern multi-expansion engines. The older types of engines have nearly all been greatly improved in detail, and there is a constant tendency for smoother running and better regulation. The exploitation of the electrical business has done much toward the development of steam practice. While there have been no marked improvements—except, possibly, for the steam turbine and the higher speed engines—the general operating results have been materially bettered.

The constant-current transformer is here to stay, and street illumination by series alternating enclosed arc lamps seems to be a decided improvement over the old series continuous current open arc. The distribution of light is very materially improved, and the serious objection to the old open arc of lack of uniform illumination has been partially obviated.

Gas engines are now being built with satisfactory regulation and of any desired

size. Two central stations, to the writer's knowledge, have adopted them as prime movers, and have selected sizes as high as 650 horse-power.

Aluminum wire is already in satisfactory use as a substitute for copper conductors; and, in view of the inflated price of copper, it would seem advisable to use aluminum as much as possible, to assist in bringing the price of copper to a more reasonable figure.

The use of exhaust steam for heating neighboring buildings, either by its direct transmission or by the circulation of hot water, is being adopted by numerous plants.

The distance and high voltage limit of transmission is being constantly increased; and one of the recent plants exploited will transmit current for an extreme distance of 155 miles at 60,000 volts. Two installations will be made during the coming year, of 25,000 volt cables underground.

An Electromobile Ambulance.

The manufacture of producer gas is capable of further development and economy; and even under present conditions producer gas and gas engines will yield a unit of energy for the least consumption of fuel. This field deserves the serious attention of engineers. It has a special value to central stations and other power plants with an irregular load. The best steam engines are only economical between certain ranges of load, and are generally very uneconomical on light loads. The average boiler and furnace of an electric light plant works at a high efficiency only during a fractional portion of the day. Economy can not be maintained on a boiler plant except that the grate surface be worked at practically a constant favorable capacity. As the load falls off, the flame temperature diminishes, which of itself is disadvantageous and is apt to be accompanied by great over-ventilation of the fire.

A producer gas furnace—barring radiation—has about the same efficiency at all loads, and gas can be stored, while the storage of steam is almost impossible and the storage of electrical current is not always practical or economical.

The necessity of a better distribution of street lighting is fast becoming apparent and the incandescent lamp may yet prove a formidable rival in this field. I know of no city where it has been given a fair trial. A better knowledge is needed of the photometric value of arc lighting, and a committee has been appointed for this investigation by the National Electric Light Association, and some interesting developments may be expected.

The average central station is handicapped for the following reasons:

First. Improper and insufficient education of operatives.

Second. Poor accounting.

Third. Lack of capital.

Fourth. Inequitable rates.

The ultimatum of perfection in central station operation requires education in all branches of engineering, accounting and business methods. Good judgment and diplomacy are such necessary attributes that their mention here would be superfluous.

(To be concluded.)

The Electromobile Ambulance of St. Vincent's Hospital in New York City.

The illustration herewith gives an excellent view of the first electromobile ambulance used in New York city, and probably the first in use anywhere. It has been presented to St. Vincent's Hospital by a donor who has hidden his good deeds from the public by remaining anonymous.

The ambulance was built by Messrs. Frederick R. Wood & Son, of New York, who constructed the body and gear. The body is upholstered in the most approved style. The windows are all bevel plate-glass and the interior of the vehicle is lighted with a marine lamp of 10 candle-power, while two carriage lights of the same power are used in the side lanterns. The gear is, singularly enough, of the pedestal variety similar to that once in vogue for horse-drawn street cars. The object of this construction is to obviate the use of reaches which give the vehicle a clumsy appearance, while the pedestal gear permits the vehicle to run over uneven surfaces without the strain on the body involved when a rigid running gear is used. The machine is steered by its front wheels. Two motors, each of two horse-power are used, these being suspended on the rear axle. The battery box under the body of the ambulance carries 44 cells of accumulator.

The controller is situated under the driver's seat and is entirely enclosed from the weather and out of sight. The vehicle has three speeds forward and two backwards, its maximum speed being 15 miles an hour. It is estimated that it will run more than 70 miles on one charge.

Solid rubber tires are used and rawhide gearing has been adopted to lessen the noise of the machinery as much as possible. The vehicle reflects great credit on its designers and constructors and no doubt will be immensely appreciated by the hospital to which it has been given.

Free Trade in Electricity.

The Niagara Falls Power Company has passed a resolution stating that the company is opposed to a duty upon electricity generated in Canada and transmitted to the United States; that the imposition of such a duty is not required for the protection of any American industry; and that it might invite retaliatory legislation by the Canadian Government.

OBITUARY.

Professor Edward Hughes, the inventor of the Hughes printing telegraph instrument and other electrical apparatus, died in London on January 22. He was educated at Bardstown College, Kentucky.

SCIENCE BREVITIES

Chemical Action of Roentgen Rays—Since the chemical action of Becquerel rays upon oxygen has been discovered by P. and S. Curie, another link has been traced between those rays and Roentgen rays. For, as P. Villard points out, says one of Mr. E. E. Fournier d'Albe's abstracts, Roentgen rays also exert a chemical action, not only upon photo-sensitive salts, but upon substances contained in some kinds of glass. The author expresses this fact drastically by saying that radiographs can be obtained with simple glass plates instead of sensitive plates. The coloring action of Roentgen rays upon the tubes generating them is well known. The portion of the tube which lies in front of the plane of the anticathode takes a violet or brown tinge, according to the composition of the glass. Villard encloses the anticathode in a wide tube, and protects the inner surface of the latter from the action of diffused cathode rays by a lining of aluminum foil. In that case only a violet coloring is produced, even in ordinary lead glass. On removing the aluminum lining the lead glass is colored brown, owing to the oxydation of the lead by the diffused cathode rays. No color is produced behind a platinum screen. The author proposes to make a silicate in which the reducing action should be more pronounced and apparent.

Electrical Conductivity of Calcium Carbide—Herr G. Hanestop, in a recent article contributed to a German electrochemical publication, described an experiment undertaken to determine the electrical conductivity of fused calcium carbide. He used metallic rods imbedded in the mass and discovered that the electrical resistance varied between 430 and 630 times that of an equivalent mass of mercury.

The Allotropic Varieties of Iron—In order to explain certain peculiarities of steel, says London *Engineering,* M. Osmond and others have been led to assume the existence of two allotropic modifications of iron, *viz.,* "A" iron stable at ordinary temperatures, and "B" iron stable at high temperatures. In a recent communication to the Paris Academie des Sciences, M. Galy-Actie describes some experiments which tend to confirm the hypothesis noted above. The metal used by M. Galy-Actie was almost chemically pure iron, carbon was totally absent, and there was only a trace of phosphorous. The iron was drawn into wire eight millimetres (0.315 inches) in diameter, and this wire was then cut up into 1,000 small cylinders 13 millimetres (0.51 inches) high, which were annealed at 1,000 degrees centigrade (1,832 degrees Fahrenheit). These cylinders were then compressed, and a curve obtained showing the relation between the compression and the pressure producing it. The specimens proved very homogeneous; crushing commenced at a load equal to 18 kilogrammes per square millimetre (11.43 tons per square inch), there being a well-marked breaking-down point. The permanent set under this load was 1-10 millimetre (1-254 inch). If, after the set had appeared, the load was relieved and immediately reapplied, crushing only recommenced when the highest pressure previously attained was reached, and the new stress-strain curve exhibited no breaking-down point. If, however, some hours were allowed to elapse before reapplying the load, the cylinder would support without fresh crushing a load considerably in excess of the highest previously applied; and when finally crushing did occur, the event was characterized by a well-marked yield-point. It was thus possible to raise the yield-point of the material far above its initial value. All cylinders annealed after heating to a temperature exceeding 850 degrees centigrade, showed a well-marked yield-point, but if quenched from this temperature and then tested at once, the yield-point disappeared, the stress-strain curve becoming uniform throughout. If, however, a certain time was permitted to elapse before testing the specimen, the yield-point would make its appearance, and this recovery of the metal to its primitive condition could be hastened by applying quite a moderate heat. If the metal was quenched from a temperature below 850 degrees centigrade, the yield-point was always present. M. Galy-Actie interprets his experiments as proving the existence of the two allotropic modifications of iron. The "B" iron can be produced at ordinary temperatures, either by mechanical deformation or by quenching, but is essentially unstable, and gradually changes into "A" iron.

Selenium — We have now received further details of the experiments carried out by M. Perreau on the influence of the Rœntgen rays on selenium, says the London *Electrical Engineer.* He experimented with a thin strip of selenium which had under normal conditions a resistance of 40,000 ohms. It was contained in a zinc box which could be closed by an aluminum lid. The resistance of the strip when exposed to the diffused light from a gas-burner placed about five feet away rapidly fell to 33,000 ohms. When the light was withdrawn, the resistance returned to its original value very quickly. The strip was then exposed to the rays coming from a Crookes tube placed at a distance of about two inches from it. The resistance rapidly diminished till it reached 34,000 ohms, small variations of the same taking place, which the author attributes to the variation of the intensity of the rays given off by the tube. When the tube was shut off the resistance of the strip gradually returned to the first value, it being remarked that this return was much slower than after the exposure to gaslight. The reduction of the resistance, of course, diminished as the Crookes tube was removed further away from the strip, but it was still appreciable when the tube was some seven inches away from the strip. The interposition of substances more or less transparent to the cathode rays sensibly affected the reduction in resistance.

Chicago Electrical Association.

The Spring programme of the Chicago Electrical Association, which meets twice a month at 1736 Monadnock Building, Chicago, is as follows:

February 2, 1900, "Copper Economy of Transmission Lines," B. Frankenfield, engineering department, Western Electric Company.

February 16, 1900, "Electrolytic Deposition of Metals," C. F. Burgess, department of electrical engineering, University of Wisconsin, Madison, Wis.

March 2, 1900, "Recent Progress in the Field of Electro-Chemistry," H. R. Kingman, chemical laboratory, Western Electric Company.

March 16, 1900, "Arc Lighting," F. N. Boyer, manager supply department, General Electric Company, Chicago.

April 6, 1900, "Laboratory Methods," Professor Irwin J. Macomber, department of electrical engineering, Armour Institute.

April 20, 1900, subject to be announced, C. A. Brown, patent attorney.

May 4, 1900, "Road Test on Street Railway Motors," Professor Philip B. Woodworth, department of electrical engineering, Lewis Institute.

May 18, 1900, annual banquet.

The present officers of the association are: J. M. Hollister, president; J. R. Cravath, vice-president; Harold Almert, treasurer; R. F. Schuchardt, secretary; H. G. Dimick, auditor and librarian; Thos. G. Grier, F. S Hickok and C. H. Sewall, directors.

The Bicycle-Automobile Show in New York City.

A large crowd attended the opening of the bicycle-automobile exposition at the Madison Square Garden, in New York city, last Saturday night. Much interest was displayed in the different exhibits of automobiles of which many new types and handsome designs were shown. The American Electric Vehicle Company showed four very handsome vehicles of its new types, comprising an American runabout buggy for two passengers (having a two and one-half horse-power motor and

General Electric Automobile Company's Two-Seated Runabout.

speeds from starting to 15 miles an hour), another type similar to this but with pneumatic tires, a vehicle called the American break, designed for four passengers and equipped with a four-horse-power motor, giving a speed of 14 miles per hour. This company also exhibited its new "American" delivery wagon. This wagon is eight feet long, 44 inches wide and 48 inches high inside. It has a speed of 12 miles per hour. It is very strongly made and is capable of carrying a load of 2,000 pounds. The exhibit is in charge of Mr. Percy Ballantine, and is situated on the main floor of the building.

The Eddy Electric Manufacturing Company, of Windsor, Ct., had on exhibition a new electric controlling device for automobiles. This device is fitted with a heavy knife contact and quick break. It is arranged for both forward and back speeds on the same lever, forward movement giving three speeds, the back two. It has only recently been placed on the market by the company and has many advantages over the old controller, being very simple in operation; it is claimed that it does not arc. This company also had several other exhibits, one showing a running gear complete, equipped with a No. 14 motor, which is a 75-volt machine of 2.44 rated horse-power; also the new Nos. 3, 12 and 13 carriage motors. In another corner of the booth is displayed an electro-plating machine with the "Indestructible" armature winding of low-speed containing two coils for two voltages at the same time. This exhibit is in charge of Mr. O. J. Smith.

The Indiana Bicycle Company has a very attractive exhibit of eight wagons: a runabout with a speed of 30 miles; a Stanhope with a speed of 38 miles; a Newport break, extra size, carrying six passengers; it also exhibits a small four-passenger break, a dos-a-dos trap, and a heavy delivery wagon, with a carrying capacity of 1,000 pounds. One of its exhibits which attracts considerable attention is a combination vehicle, which by sliding off the top and placing a seat in the space provided, can be changed from a delivery wagon to a very handsome pleasure carriage for four passengers. This wagon has a speed of 38 miles, and when used as a delivery wagon has a carrying capacity of 500 pounds. The change in this carriage is so complete that when made it can not be told from a regular pleasure vehicle. The exhibit is on the main floor in charge of Mr. F. M. Hoblitt and Mr. R. H. Haseler.

The General Electric Automobile Company, of Philadelphia, exhibits its two-seated runabout buggy equipped with two motors.

To the right of the main floor, on entering the building, the Riker Electrical Vehicle Company, of Elizabethport, N. J., has a very handsome exhibit of seven wagons, among which is a theatre bus, designed for a public passenger carriage. It is a facsimile of one at present used in New Haven. Its capacity is 14 passengers and it has a speed of 10 miles an hour, with a possibility of running 30 miles without recharging the battery. Another exhibit is a mineral-water siphon delivery wagon, the property of Mr. Carl Schultz, which has been in use since November 1, through the city, and shows very little wear. It has a capacity of 2,800 pounds. This company also has on exhibit two of its runabouts which have been used since last May through country roads and in rough weather. The machines have the appearance of having just left the works, there being no wear visible on any attachment or part. The exhibit is in charge of Messrs. Adams and Milliken.

Foster & Company, of Rochester and New York, show a very attractive line of pleasure vehicles.

The Loomis Automobile Company, of Westfield, Mass., shows a very neat model of its No. 1 Park wagon, intended for use in cities and parks. The wagon is equipped with a two and one-half horse-power gasoline motor, geared to run from 1 to 15 miles per hour. The motor is self-oiling, and all the running parts are mounted on ball bearings which are packed in a lubricant and will run for a considerable time without attention.

Third Avenue Railroad Company.

Mr. William H. Curtiss, private secretary to William Rockefeller, has been elected treasurer of the Third Avenue Railroad Company, of New York city. Mr. John Beaver, who has been treasurer, has been made assistant treasurer and auditor. The election of Mr. Curtis is taken to mean that the Standard Oil interests have entered the field of electric traction in New York city through the Third Avenue Railroad.

Damages For Cuban Cable Cutting.

The President has sent to Congress the claim of the Cuba Submarine Telegraph Company for $40,870 for expenses incurred in repairing cables and property destroyed by American war vessels during the war with Spain. The claim was presented through the British Foreign Office and the State Department.

National Electric Light Association.

The twenty-third convention of the National Electric Light Association, will be held at Chicago on May 22, 23 and 24, 1900.

PERSONAL.

Mr. C. D. Crandall, manager of the Western Electric Company, Chicago, after being confined to his room for a month through an accident to his foot which required complete rest, is again able to be out. The sprain was quite a severe one, and Mr. Crandall's ankle had to be encased in a plaster cast for several weeks.

Mr. J. Mendiola Boza, the proprietor of the electric lighting plant at Costa Rica, C. A., is a New York visitor accompanied by his daughter. Mr. Boza speaks only the Spanish language, but with his daughter as interpreter, is enjoying his visit to the metropolis, and is enabled to easily transact his business with electrical houses.

Mr. C. S. Sergeant has been promoted to the vice-presidency of the Boston Elevated Railroad. General W. A. Bancroft has been advanced from the post of general manager to that of executive head of the road. Mr. Sergeant is a former president of the American Street Railway Association, and is a man well known in the street railway field.

Mr. William D. Sargent, vice-president and general manager of the New York & New Jersey Telephone Company, has been elected a director of the National City Bank, the leading national bank of Brooklyn, N. Y. The election is in every way an admirable one, and the bank is to be congratulated on securing a gentleman of Mr. Sargent's wide acquaintance, ability and character.

Mr. E. R. Weeks, former president of the National Electric Light Association, has been elected vice-president and general manager of the associated interests of the electric lighting companies of Kansas City, Mo. Mr. Weeks is an able and progressive representative of electric lighting interests, and the new organization is to be congratulated on securing his services. His associate officers are: President, Conway F. Holmes; chairman of the board of directors, P. A. Valentine; vice-president, L. E. James.

Mr. H. C. Cushing, Jr., author of the handbook "Standard Wiring," the recognized authority on electric wiring and construction from the fire underwriters' as well as the engineers' standpoint, has opened an office at 39 Cortlandt street, New York, as consulting electrical engineer and fire insurance broker. Mr. Cushing's combined experience, in both the electrical engineering and insurance fields, will make his services as a broker in placing insurance on manufacturing plants most valuable, as a thorough knowledge of electrical and mechanical construction is essential in these times in securing the lowest rates and best forms of policy for the manufacturer.

A Tribute to the Late S. Dana Greene.

To the Editor of Electrical Review:

May I trespass on your space far enough to say what occurs to me about the late S. Dana Greene?

His place in the class of naval cadets at Annapolis, to which he belonged, was so high that he might with confidence have looked forward to the highest preferment in a service to which he was devoted, yet he manfully gave up his chance of being an admiral, because he could not see his way to remaining in the navy without encroaching upon his mother's slender income. In after life, when he had become a successful business man, he always cherished the earliest object of his awakened ambition, though he never openly expressed regret that he had followed what seemed to him to be the path of duty.

In his business career he climbed the ladder of promotion by self-denying, diligent and honorable service, respecting himself, respecting his employees, and respecting the work which fell to his hands to do. In his intercourse with his official superiors, equals and subordinates, as well as with his customers and the outside world, he was tactful but truthful; reserved but sincere; often cordial but never familiar; prompt, energetic and accurate in discharging his multitudinous duties.

To find his attitude on any given question which might arise, one had only to determine what would be the view of a tolerant, impartial and honorable spectator, his zealousness for his company's advancement never betrayed him into sharp practice, he gained universal esteem by his uprightness, and held it by his serenity.

To this man at the early age of 35 had come a splendid position in the business world, official recognition of his energy and ability as a volunteer defender of the state and nation, ample means and a charming home in which was enshrined a woman in every way worthy of him. To-day they seem "but as yesterday when it has passed, and as a watch in the night."

Yet their lives, and more conspicuously his, are full of encouragements and fruits. In these days when men so often consent to lower their standard of business integrity for the sake of gain, it is well to bear in mind that S. Dana Greene left his chosen vocation in life at the call of duty, and achieved success and some measure of fame in necessity's field with ideals intact and with untarnished honor.

Ignotus.

New York, January 11, 1900.

MODERN DEVELOPMENT IN ALTERNATING-CIRCUIT SERIES ARC LAMPS.*

BY R. FLEMING.

The development of arc lighting by means of alternating currents has been, all things considered, extremely slow. This is especially the case with arc lights in series.

Series lighting by direct current has, for many years past, reached a degree of perfection which it is doubtful can be improved upon, especially as regards the method of generating and distributing the current. Even in the years gone by, when methods and apparatus were crude, it was possible to obtain reasonably good services from such apparatus as could be secured, even taking into consideration the fact that the attendance and care which the apparatus received was such as could be given by an extremely poor class of help. Now, however, men as well as methods have improved, and it is possible even for the smallest central station to have its apparatus cared for in the most thorough manner. This, too, is made easier as the question of insulation and the handling of high potentials is now extremely well understood.

But even with the most perfect style of direct-current apparatus obtainable, there is yet a great deal to be desired in the way of flexibility of operation. It is necessary, for high-potential arc-lighting work, to have a small generating unit of comparatively low efficiency; this in turn to be driven by a small engine of low efficiency or a line shaft of still lower efficiency or by a synchronous motor, which latter method also has its disadvantages. It has long been the dream of a great many to be able to design a central lighting plant capable of furnishing all manner of light and power from a single unit, or a single class of units, of a size large enough to enable them to be operated under the most favorable conditions and at the highest possible efficiency, electrically and mechanically. While limited to direct currents for street lighting and series-arc lighting in general, this dream was not easy of fulfillment.

The method of driving direct-current arc generators by means of synchronous motors supplied with current from alternating generators can hardly be called a method of lighting by means of alternating currents, being a complete regeneration of the current, and, in fact, has many of the limitations of a system of arc generators driven by small steam units.

* A paper read before the Northwestern Electrical Association, Milwaukee, January 17, 1900.

It is of comparatively low efficiency; there is a large amount of moving machinery, and it is quite complicated, requiring a large amount of floor space in the central stations as well as a large amount of extra attendance.

Series arc lighting from alternating currents is not, by any means, of recent date. Experiments in this direction have been carried on from time to time ever since the oldest and crudest of alternating generators has been made.

Until recently the most successful method was that of using a special alternating generator designed to have extremely high-armature reaction separately excited and supplying open arc alternating lamps. This method had all the disadvantages of a direct-current system of distribution, as well as a great many others inherent in the system itself. The generator, while theoretically ideal, was a very difficult machine to operate, and was of low efficiency. The power factor of the system was also low. The lamps were of a very crude design and extremely noisy; the light given off was of a poor quality and the operation of the lamps was anything but perfection.

Several schemes of supplying alternating arc lamps in series from constant potential circuits have been proposed from time to time, and several have been supplied to the market with varying degrees of success; few, however, reaching the point of becoming of any extended application, and most of them died in their infancy.

The advent of the constant-current transformer and the alternating enclosed lamp have changed the whole aspect of series arc lighting from alternating current circuits. With these transformers, it is possible to do anything that can be done with any form of direct-current arc generator. The regulation is as good or even better than can be obtained from these machines, and this, too, is obtained without the use of complicated external means of accomplishing this end. These transformers possess the quality of "inherent regulation" which we occasionally hear so much talked about to a higher degree than any other class of apparatus made.

The principle on which the transformer operates is that beautiful one discovered by Elihu Thomson a number of years ago. This was first brought to the attention of the public by his classic experiment with the floating incandescent lamp. No one can help being struck by the beauty and simplicity of this experiment.

In the constant-current transformer the simplicity of the floating lamp is very nearly duplicated, except that the necessary leads are used to make connection with the moving coils, but these are so arranged that they are of the utmost simplicity of construction and in no way liable to become deranged.

In the practical application, all these transformer parts are reduced to a minimum, and it is hardly possible to conceive a piece of apparatus that will accomplish so much with such an extremely simple arrangement of parts.

Hence it is perfectly feasible to completely short-circuit the secondary winding of the transformer and without any further manipulation, apply the primary current at full potential without in the least damaging the transformer and with extremely slight disturbance to the circuit to which it is attached.

(To be concluded)

CENTRAL STATION HEATING IN CONNECTION WITH ELECTRIC LIGHTING PLANTS.*

BY W. H. SCHOTT.

One year ago we listened to a paper, by Mr. J. H. Harding, on the subject of utilizing exhaust steam. This paper created more or less interest upon this subject and started a great many of us thinking.

In every manufacturing plant the shrewd manager is always trying to find some way of utilizing everything in the form of a by-product that he may happen to have in his particular line, and the up-to-date electric light manager should be on the same plane.

A few years ago investors believed that all that was necessary to draw large dividends was to purchase a certain kind of apparatus, put in almost any kind of a steam plant, and they would have a complete station and as soon as the light was turned on the dividends would begin to roll in; but, later on, some of these same investors found that instead of having a gold mine they were loaded with an elephant. They had been led to believe that they could put in any particular system, employ any novice to run same and it was all right, but they found that the expense kept constantly increasing; why, they did not know. First one stockholder would try his hand at running it and then another, and finally they would employ an expert to operate for them. This has been the experience of a number of plants throughout the country. Investors now know that in order to make an electric light plant pay it is necessary to construct it on the very best lines and then operate it accordingly.

*A paper read before the Northwestern Electrical Association, January 18, 1900.

The average plant uses simple non-condensing engines and, as a matter of course, has a large number of heat units constantly going to waste. These heat units should be utilized and in most cases can be utilized if the proper apparatus is installed. What to install is an engineering problem that should be passed upon by some one competent to judge.

Within the last few years a few plants throughout the country have installed exhaust steam systems for heating, trying to secure a new earning power after having utilized the steam for the purpose of driving their electric load. After my own investigation of both the exhaust and hot water systems I was convinced that for certain cases the exhaust steam, either using back pressure on the engines or a vacuum pump as the case might be, would be all right for certain cases, but where it required an extensive system to cover scattered areas it was impractical on account of the heavy investment required. But with the hot water system in towns where the business is located within two miles of the power station, it could be taken care of from one power house at a minimum cost compared with a steam plant. The hot water system can be installed more cheaply than the exhaust steam, as smaller pipes may be used to do the same amount of work, they require less expensive insulation, on account of lower temperatures, the expansion is not so great, consequently fewer expansion joints are required, and with the hot water system heat can be stored up during such times as a surplus of steam exists and utilized when the amount of steam going to waste would be insufficient to do the required work.

To the consumer, in addition to offering a uniform heat, you can offer hot water for bath and laundry purposes, which will secure at least 30 per cent of the business

The average electric light plant in our smaller cities has had, as a basis of starting, a city contract. In this day and age we have to realize that we must put our plants where we are independent of a city contract, so that, in case it is lost, our business has not been destroyed and investment gone. I do not know of a better way to do this than to put in a heating plant to utilize the exhaust steam, which is our by-product, and by the proper disposal will increase our earning power and secure our investment; at the same time in so doing you are establishing something which every city is bound to have, namely, a central heating station.

Train Lighting From the Car Axle.

Among the many applications of electric lighting there is none that has presented a more difficult, and at the same time interesting, problem than that of lighting railway cars and trains. The great advantages of the electric light over other forms of illuminants are nowhere more manifest than on a train where the absence of odor, smoke, dirt, etc., and the steadiness of the light in drafts of air, taken with its total freedom from attention, all combine to make it the most popular light with the patrons of railways. The method of train lighting here illustrated is one which employs the motion of the car axle as the source of the generation of electricity in lighting the train. The great difficulty with the use of an axle as a source of power is that it runs at all sorts of speeds, sometimes stops, and not infrequently runs backwards. It is, therefore, entirely out of the question to drive the lights directly from a dynamo attached directly to the axle, so that the method adopted by the Electric Axle Light and Power Company, whose system is here illustrated, is to use in conjunction with the dynamo a storage battery of sufficient capacity to operate the lights in a car for twenty hours. A dynamo attached to one of the trucks charges the battery whenever the train is running fast enough, and when it is moving slowly or standing still, the battery supplies the necessary current to the lamps. An automatic switchboard makes the necessary connections between dynamo and battery and reverses the direction of current of the former when the train is running in a reverse direction.

The dynamo is driven from the axle by friction pulleys which are, of course, noiseless in operation and prevent an injurious overload on the system. Fig. 1 shows the dynamo hung from the truck by a tension rod which holds it against the split pulley on the car axle and keeps the friction driving gear in contact. Fig. 2 shows two views of the dynamo employed, which, it is seen, is generally similar to a railway motor in design and is completely enclosed. It is stated that on trains making transcontinental trips these dynamos have passed within a few hours through deep snow, alkali dust, the grit of the plains, and excessive conditions of both dryness and moisture and yet have been in continuous operation for three years of this sort of service. The machine is built to maintain an electro-motive force of from 32 to 40 volts according to its speed. It is so wound that after the train has obtained a speed of, say, 10 miles an hour, additional speed causes the voltage to rise very slowly. No switches or automatic mechanism is used beneath the car, all these devices being placed in a box and adapted to be put in any convenient situation inside the car.

The action of this switch box can be understood most easily by following the train through a cycle of speed changes. When the car is at rest, the box has switched the dynamo out of circuit and the lights are being fed with 30 volts pressure by the storage battery. When the car starts and begins to gain speed, the dynamo voltage builds up. When this has reached a potential above that of the lamps the machine is switched in multiple with the storage battery and the lighting circuit. At the same time resistance is cut in to hold down the voltage in the lighting circuit to the standard of 30 volts. As long as the car is moving faster than 10 miles an hour this condition holds. If it slows down below this speed the dynamo is automatically cut out. As it is delivering no current at the time, there can be no spark at the switch jaws, for which reason it is claimed that the automatic switches require no attention year in and year out. The storage battery used in this system is hung under the car and as it is always used near the full charge limit, it is under a regimen calculated to prolong its life to the greatest degree.

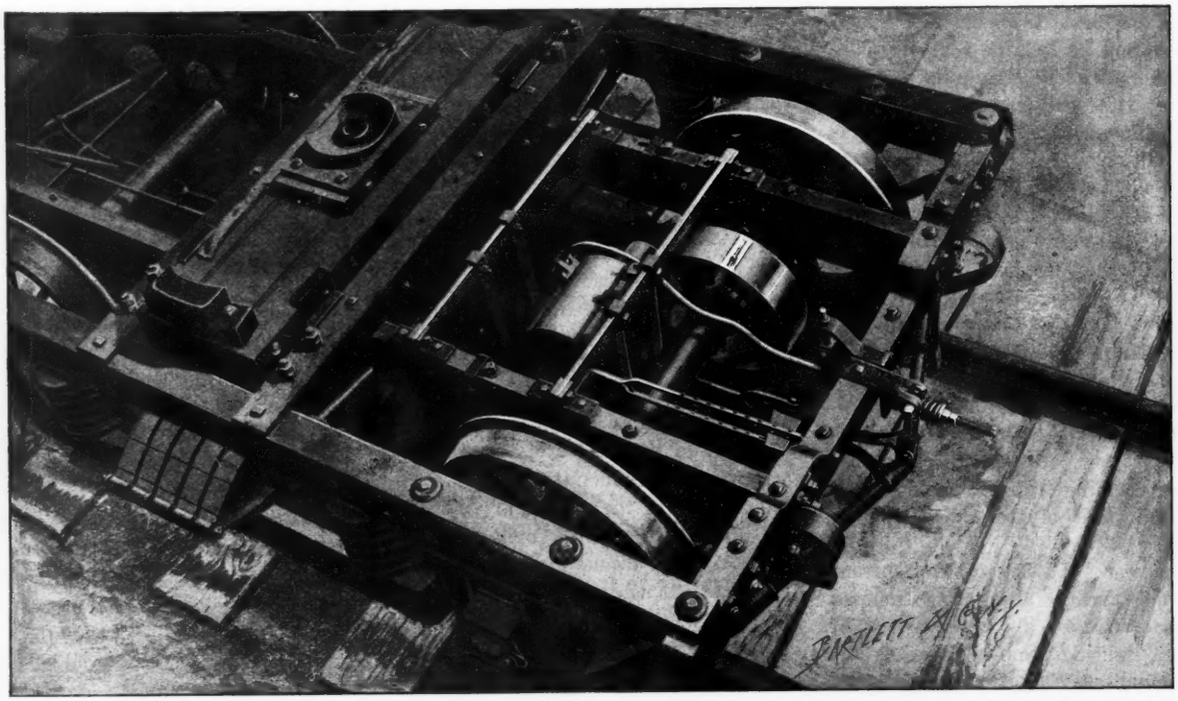


FIG. 1. - "TRAIN LIGHTING FROM THE CAR AXLE"—DYNAMO IN PLACE ON THE CAR TRUCK.

The same company is also constructing an interesting application of refrigeration methods for cooling cars in which perishable articles are shipped. As is well known, the present type of refrigerator car is cooled by means of ice packed in chambers occupying about one-sixth of its entire interior. The disadvantages of this system are so obvious that it is unnecessary to describe them here. The new

method that is being applied by the Electric Axle Company uses cold, dry air which is produced by electrical means during the travel of the car. A method of generating current and using a storage battery appliance similar to that described above is in use. It is stated that on a transcontinental run with such a car the temperature was kept below 30 degrees Fahrenheit with the outside temperature at about 70 degrees most of the time.

Wall Street and the Electrical Stock Market.

During the past week in the stock market speculative sentiment was conflicting, and the market evidenced the want of what is known as "buying power." The price changes for the week were limited and the dealings were in smaller volume than for many months. The money market is easier and the outlook in this direction is clearer than it has been for some time.

On the New York Stock Exchange General Electric closed the week at 122 bid and 123½ asked, showing a loss of 1 point in the bid price for the week. Metropolitan Street Railway, of New York, closed at 164 bid and 164⅜ asked, a loss of 1⅜ points for the week. Third Avenue Railroad, of New York, closed at 111¾ bid and 111⅞ asked, a loss of 11⅜ points for the week. The refunding of the large floating debt of this company is referred to elsewhere in this issue of the ELECTRICAL REVIEW. Brooklyn Rapid Transit closed at 70½ bid and 70⅝ asked, a gain of 1¾ points for the week. Manhattan Railway, of New York, closed at 93¼ bid and 93½ asked, a loss of ½ point for the week.

On the Boston exchange, American Bell Telephone closed at 329 bid and 330 asked, a loss of 3 points in the bid price for the week. Erie Telephone closed at 103 bid and 104 asked, a loss of 1 point for the week.

On the Philadelphia exchange, Electric Storage Battery was not quoted. Union Traction closed at 37⅞ bid and 38 asked, a loss of ¾ of a point for the week. Electric Company of America closed at 12¾ bid and 12⅞ asked, a loss of ⅝ of a point for the week.

On the curb or outside market in New York, Electric Vehicle closed at 48 bid and 55 asked, a loss of 5 points for the week. Electric Boat closed at 18 bid and 19 asked, a loss of 5 points for the week. Electric Axle closed at 4½ bid and 4⅜ asked, a loss of 1⅛ points for the week.

Wall Street, January 20, 1900.

New York Electrical Society.

The following members were elected at the 201st meeting of the New York Electrical Society, held on January 17: J. L. Kruger, 953 Myrtle avenue, Brooklyn, N. Y.; George H. Watson, 141 Broadway, New York city; Frank H. Roth, 165 Railroad avenue, Brooklyn, N. Y., and Joseph Hoffman, 2 West 118th street, New York city.

Franklin Institute.

At the meeting of the electrical section of the Franklin Institute, Philadelphia, on January 23, Prof. John Price Jackson read a paper, entitled "Electrical Machinery for Use in Coal Mining." These officers for 1900 were elected: Prof. W. S. Franklin, president; Joseph Richards, first vice-president; Geo. T. Evanson, second vice-president; Richard Binder, secretary.

Kings County Light Company's Officers.

The Kings County Electric Light and Power Company, of Brooklyn, N. Y., has elected these officers for the ensuing year: Anthony N. Brady, president; A. M. Young, vice-president; A. W. Dater, treasurer; A. N. Neilson, assistant treasurer; and W. W. Freeman, secretary.

Bernard Gallagher has resigned the presidency of the Edison Electric Illuminating Company, of Brooklyn, and Anthony N. Brady has been elected to that position. The annual meeting of the Edison Company occurs on January 26.

Municipal Ownership Debate.

President Wickersham, of the Marquette Club, Chicago, announced last week that the club had arranged for a discussion of the subject of "Municipal Ownership and Operation of Street Railway and Other Municipal Utilities," at a banquet of the club on January 27. The speakers are to be Governor Hazen S. Pingree, of Michigan; Charles T. Yerkes, and Professor J. Laurence Laughlin, of the University of Chicago.

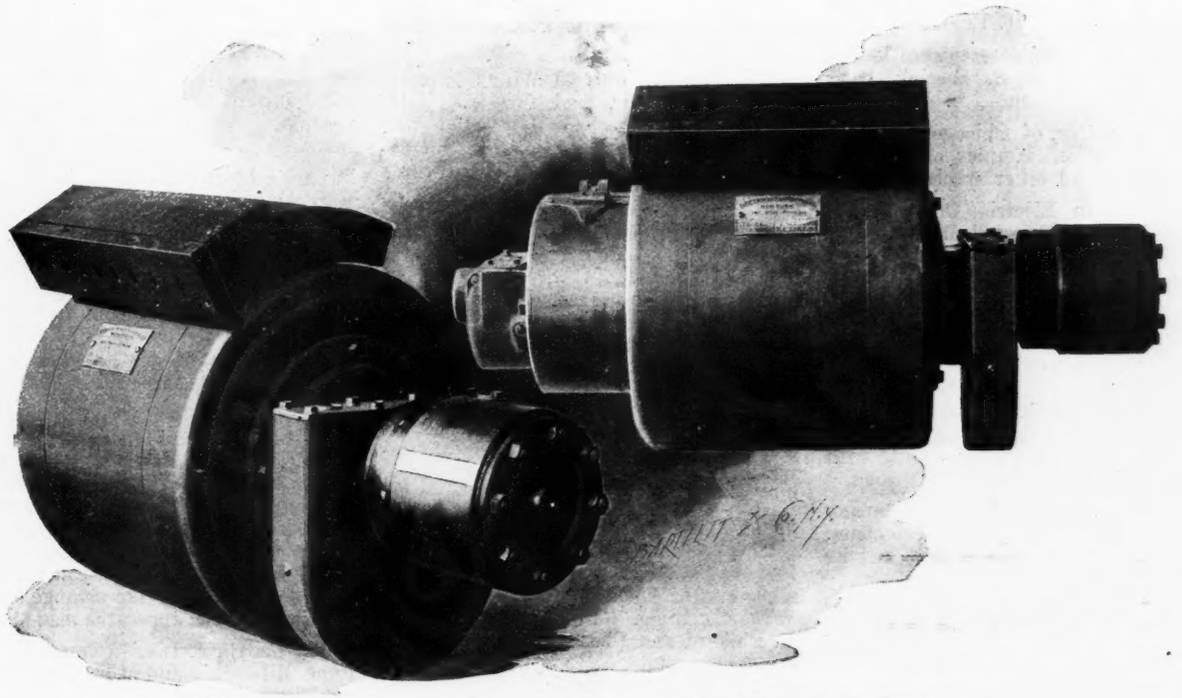


FIG. 2.—"TRAIN LIGHTING FROM THE CAR AXLE"—TWO VIEWS OF THE DYNAMO.

NORTHWESTERN ELECTRICAL ASSOCIATION CONVENTION NOTES.

The Central Electric Company, Chicago, was represented by Mr. F. M. Pierce.

The Electrical Supply Company, Madison, Wis., was represented by Mr. L. W. Burch.

The International Correspondence Schools, of Scranton, Pa., had representatives at the convention.

Mr. W. M. Smith looked after the interests of the Chicago Insulated Wire Company at the convention.

E. K. Patton, of the Perkins Electric Switch Manufacturing Company, of Hartford, represented his company.

M. B. Austin & Company, of Chicago, were represented by Messrs. W. A. Brown, M. B. Austin and A. H. Friend.

Hart & Hegeman interests were looked after by Mr. George S. Searing, their genial Chicago representative.

Mr. Geo. Cutter, of Chicago, exhibited at the convention samples of Cutter's cutout pulley and other specialties.

The Dearborn Electric Company, of Chicago, had its interests looked after by Mr. Chas. Messer, its president and treasurer.

The Guarantee Electric Company, of Chicago, of which Mr. Chas. E. Gregory is president, was represented in person by Mr. Gregory.

The Simplex Electrical Company, Boston, Mass., was represented by Mr. H. R. Hixon, its Western selling agent, with offices at Chicago.

The John A. Roebling's Sons Company distributed handsome pocket calendars. Mr. A. B. Conover, of Chicago, had its interests in charge.

Messrs. Stenz, Meyer & Company, of Chicago, manufacturers of the "Shadowless arc lamp globes," had samples of their globes in their rooms.

James Wolff, of the New York Insulated Wire Company, greeted, in his usual graceful way, the customers and friends of his company.

The American Electrical Works, of Providence, R. I., was represented by Mr. E. H. Hammond, of the company's western office at Chicago.

The Kuhlman Electric Company, Elkhart, Ind., makers of Kuhlman transformers, was represented by Mr. E. Kuhlman, manager of the company.

The Leschen–Macomber–Whyte Company, of Chicago, was represented by Mr. Geo. S. Whyte, who would rather miss a week's salary than a convention.

The Western Electric Company, of Chicago, was represented by Mr. A. L. Tucker and A. McNab Little, of the American Electric Company, St. Paul office.

Mr. J. S. Speer, of the Speer Carbon Company, St. Marys, Pa., was at the convention. Mr. Speer reports a large increase in his business, and while here met many of his customers.

The Adams–Bagnall Electric Company, of Cleveland, was represented at the convention, and was much in evidence in the person of Mr. J. G. Pomeroy, of Chicago, manager of its sales department.

The American Steel and Wire Company had two representatives at the convention, Mr. E. J. Pietzcker, of Chicago, and Mr. Channing T. Gage, of the St. Paul office of the company.

Mr. Francis Raymond, St. Louis manager of the General Incandescent Arc Light Company, Paragon Fan and Motor Company and the Chicago Rheostat Company, was warmly received by his many friends.

Pass & Seymour and the Crouse–Hinds Electric Company were represented by Mr. John W. Brooks, of Chicago. "P and S." porcelain specialties and Crouse–Hinds switches were shown here to advantage.

The Illinois Insulated Wire Company, of Sycamore, Ill., had Messrs. F. H. Alden, president, and J. Grisnowich, secretary and treasurer, at the convention. This company distributed cards which were in demand.

The Cutler–Hammer Manufacturing Company, of Milwaukee, F. R. Bacon, H. H. Cutler, F. W. Smith and J. G. Hickox, representatives, occupied rooms on the parlor floor, in which were shown Cutler–Hammer rheostats.

R. E. Lucas, of the Indiana Rubber and Insulated Wire Company, of Jonesboro, Ind., says his company has just completed a very excellent system of electric lighting throughout its entire factory, and is making many extensive improvements.

The Westinghouse Electric and Manufacturing Company had the following-named gentlemen at the convention: Walter L. Rugg, Ralph D. Mershon, W. R. Pinkard and Chas. G. Burton. They occupied a suite of rooms on the parlor floor of the Hotel Pfister.

The Warren Electric and Specialty Company, of Warren, Ohio, was well represented. Mr. H. W. Wiswell, transformer expert, was at the convention for this company. Mr. T. S. Lane was also there. This company distributed handsome calendars as souvenirs to its customers and friends.

The Illinois Electric Company, of Chicago, occupied Parlors 21 and 22, and showed a line of Peerless transformers, fan motors and "Illinois Punch." Its rooms were constantly full of visitors and friends. Messrs. Dewey Newman, C. W. Bacon, H. E. Adams and L. K. Cushing were the gentlemen in attendance at the convention.

The Gregory Electric Company, of Chicago, had rooms on the parlor floor, which were headquarters for its customers and friends. This company has been doing a large business, and states that its outlook for future business is very bright. Messrs. A. O. Kuehmsted and R. H. Watson represented the company.

The Cornell Machine Company, of Chicago, through Mr. W. B. Wood, manager, reports the sale of three of its larger engines, two for electric lighting plants in Wisconsin and one in Iowa, as a result of a visit to the Northwestern Convention. The company does a very large business, and its engines are in universal demand.

The Twentieth Century Incandescent Lamp Company showed samples of its incandescent lamp, a novelty in incandescent lighting. Its exhibit commanded universal attention. Mr. Frank McGraw, Grand Rapids, Mich., is agent for the United States, and it is stated that a factory will soon be built in this country for the company's manufactures.

The Siemens & Halske Electric Company of America, was represented by Messrs. E. Wilson, W. G. De Celle, Thomas Duncan and Edward F. Kirkpatrick. Duncan integrating wattmeters were shown here in operation, and their excellence demonstrated by the inventor, Mr. Thomas Duncan. These rooms were headquarters for many visitors to the convention. Many orders for meters were taken.

The Fort Wayne Electric Works, of Fort Wayne, Ind., had an exhibit of a few new specialties—the primary fuse-box, a combination motor-starting rheostat and automatic cutout, a new arc-lamp hanger-switch, and suspension cutout. Catalogues of Wood systems of lighting were distributed. Messrs. W. C. Knight and Frank McMaster, of the Chicago office, represented the company.

The Wagner Electric Manufacturing Company, of St. Louis, had Mr. E. H. Abadie, of St. Louis, and Mr. George B. Foster, manager of its Chicago office, at the convention. Contrary to custom, the Wagner company did not have an exhibit at the convention, but this was explained by the fact that it is so busy at the factory as to be unable to make arrangements for an exhibit of the apparatus made by it.

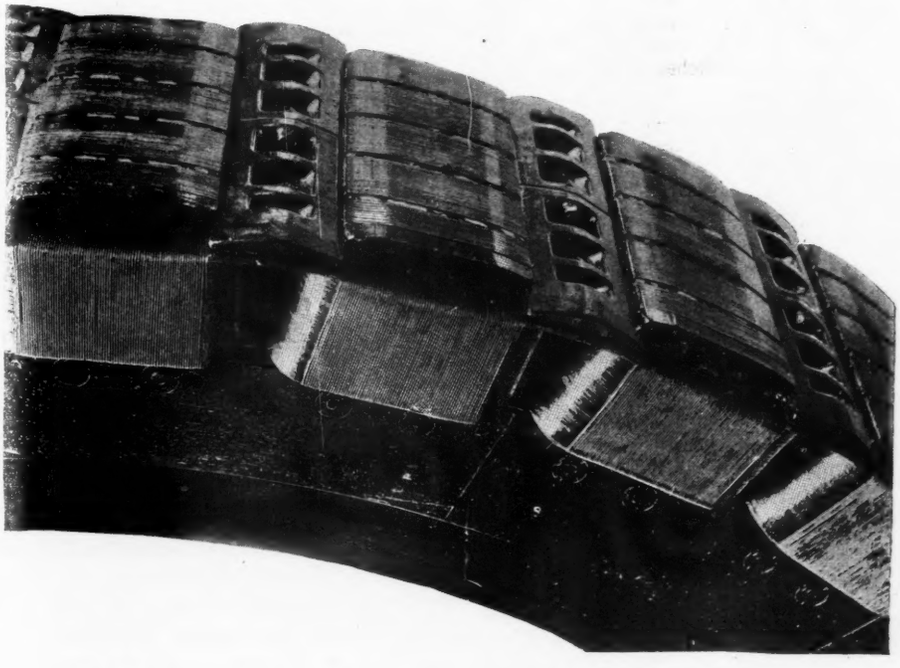
The Martin J. Insull Company, of Chicago, Milwaukee and Minneapolis, had an exhibit consisting of a full line of products made by the General Incandescent Arc Light Company, the Paragon Fan and Motor Company and Jenney Electric Manufacturing Company, and showed "G-I" arc lamps in operation; Messrs. Geo. E. C. Johnson, W. E. Pimlott, Thomas James, L. A. Carr and Francis Raymond were in attendance at the convention for this company.

The Electric Appliance Company, of Chicago, represented by Messrs. W. W. Low, B. B. Downs, W. P. Upham and S. A. Rall, showed "A–B" arc lamps, Packard incandescent lamps and Gutmann wattmeters. The Sangamo Electric Company, manufacturers of these meters, was represented by Messrs. R. C. Lanphear and J. Bunn. The New York & Ohio Company, makers of Packard incandescent lamps, had Mr. W. D. Packard as its representative. Its rooms were always full of the company's friends, and genial hospitality was fully dispensed. The Electric Appliance Company has just closed a contract for furnishing Packard incandescent lamps for all the United States Government buildings at the Paris Exposition.

The Three-Phase Generators of the Kings County Electric Light and Power Company.

The Kings County Electric Light and Power Company, Brooklyn, N. Y., whose fine plant was described at length in the ELECTRICAL REVIEW of November 22, 1899, contracted for four 750-kilowatt revolving field "engine-type" generators, three-phase, 6,600 volts, at 60 cycles, to be direct-connected to Corliss engines, running at a speed of 94 revolutions per minute. Two of these generators have been erected, and the other two are in course of shipment. The four machines are of the same type, having frames split horizontally. The rotating elements of these generators weigh approximately 60,000 pounds each, being mounted upon a spider, and are independent of the fly-wheel. A view of the details of construction is shown herewith. The hub of the spider is bored to fit the engine shaft. The pole-pieces on the generator are of laminated steel, built up of parts prepared according to the uniform practice of the builders, the Westinghouse Electric and Manufacturing Company. The fixed armatures are laminated and ventilated by ducts at right angles to the shaft. The armatures are wire wound, and the winding is of the distributed three-phase "star" type; all coils are similar.

The temperature of these generators is guaranteed not to exceed 40 degrees centigrade above the surrounding atmosphere when running on a continuous full load for twenty-four hours. The temperature does not exceed 50 degrees with 25 per cent overload; and the machine will carry 50 per cent overload for at least two hours, the temperature not exceeding 60 degrees centigrade. The capacity of the generators as noted above is based on non-inductive loads, but the generators will carry currents as above with the rise of temperature mentioned, with a power factor of 90 per cent. These generators are also guaranteed to maintain at full load an efficiency of 94 per cent, at three-quarter load 93 per cent and at one-half load 91 per cent. The regulation of the generators is such that with full non-inductive load thrown off, the rise in electromotive force is not over six per cent, the excitation and speed remaining constant.



A SECTION OF THE ROTATING FIELD OF ONE OF THE THREE-PHASE GENERATORS IN THE KINGS COUNTY ELECTRIC LIGHT AND POWER COMPANY'S STATION, BROOKLYN, N. Y.

The four generators will be operated in parallel, the wave form delivered by them being approximately a sine curve.

Two exciters of 75 kilowatts have been furnished by the Westinghouse Company, each of 600 amperes, 125 volts, direct-connected to the engine shafts, running at 275 revolutions per minute. These exciter generators have field castings vertically split, with brush holders carried by the field ring and not by the engine bearings. The armatures are bar wound, the windings are perfectly symmetrical. The series fields have windings of copper bar on edge and are entirely separate from the shunt coils.

Aluminum in 1899.

The production of aluminum in 1899 continued to be in the hands of a single company in the United States, and the quantity turned out did not greatly exceed that of the preceding year, when the total was 5,200,000 pounds, says the *Engineering and Mining Journal*. Arrangements are being made for an extension of works and a further increase of production, which will be manifest in 1900. It is to be regretted that the increase was not made in 1899, when the high price of copper and the great demand for electrical work presented an opportunity to extend the use of this metal, which may not occur again for a long time.

As it is, there were several instances of the extended use of aluminum, especially for conductors in the transmission of electric power, in which the low specific gravity of the metal gives it advantages over copper, notwithstanding its lower conductivity. In other directions there has been a gradual extension of the use of the metal for various purposes.

The foreign production is increasing, and the establishment of new works in Great Britain has proceeded successfully. The French manufacturers have also enlarged their works, and the Neuhausen Company, in Switzerland, continues to report a large output.

Prices of aluminum have remained without material change through the greater part of the year, a slight reduction in quotations having been made toward its close. The selling prices in the United States for No. 1 ingots (99 per cent pure) range from 33 cents to 37 cents per pound, and No. 2 (90 per cent), from 31 cents to 34 cents, while rolled sheets held at 42 cents and upward per pound, according to quantity purchased.

Tempered Copper Sheets.

TO THE EDITOR OF ELECTRICAL REVIEW:

Would you be so kind as to inform me where I can buy some fair quantity of sheets for electrical purposes, which were made by the Eureka Tempered Copper Company, of Northeast, who exhibited their goods in the Electrical Exhibition, of Chicago, in 1893? R. GRASSI.

6 Via S. Orsola, Milan, Italy.

Wireless Telegraphy and the War.

The *Times's* special correspondent telegraphs to London that six Marconi wireless telegraphy instruments intended for the Boers have been captured at Cape Town. The experiments at Orange River, he says, have been highly successful, the communication with De Aar, 70 miles distant, being perfect.

VIEWS, NEWS AND INTERVIEWS

Professor Rœntgen, who has accepted the call to the University of Munich, has been appointed director of the state institute of physics and metrology.

The number of submarine cables now in operation throughout the world is given as 1,500, with a total aggregate length of 170,000 miles, constructed at a cost of $250,000,000.

Arrangements for buffet cars to be placed upon both the surface and elevated roads of Chicago are now said to be under way. If the plans succeed the hungry citizen who gets up late and can not stop for breakfast at his home can have a hot meal served as he rides to work. Designs for the buffet cars contemplate an arrangement of hinged tables, about ten to a car, so planned that they can be turned up against the wall when not in use. Four seats will be placed at each table, and one waiter, it is estimated, can attend to all the patrons of a single car. Cigars and possibly liquid refreshments are among the features which may accompany the coming of the buffet cars.

The President has transmitted to Congress the claim of the Eastern Extension Telegraph Company, amounting to $4,334, for compensation on account of expenses in repairing the cables between Manila and Hong Kong, and Manila and Iloilo, cut by orders of Admiral Dewey during the Spanish war. The claim is presented by the British Government through the Department of State, and Secretary Hay, in transmitting it appends an opinion of the Attorney-General that it has no standing in law. The Secretary, however, turns the claim over to Congress in order that it may determine whether or not, as an act of comity and equity, the company should be reimbursed for actual expenses in repairing the cables.

One of the many reasons why American manufacturers are so successfully competing in foreign markets is to be found in the following episode which occurred recently: An American manufacturer of steam specialties was visiting an English firm which made similar goods. A certain article which both firms made was under discussion.

"What is your cost price on this thing?" asked the American.

"Well, in your money, about $19," replied the Englishman. "What does it cost you?"

"I'll deliver at your door all you want at $7 a piece," said the American.

"How in the world do you do it?"

"Well, I'll illustrate," answered the American. "Look out of that window and across the street. See that man painting a sign?"

"Yes."

"He's on a ladder, isn't he?"

"Yes."

"See that other man sitting on the sidewalk holding the foot of the ladder?"

"Yes."

"Now, in America we have ladders that stand up by themselves—don't need a man to hold 'em. So, you see, in this instance we divide your cost of labor exactly by two."

"I see," remarked the Englishman.

Just as the Broadway theatres were filling up one evening last week the electric lights went out. All but one of the play-houses were able to fall back on gas illumination. The one exception was Hammerstein's Victoria Music Hall at Forty-second street, which depends entirely on electricity. According to the distressed management many, many people came, saw the darkened theatre and went away thinking there would be no performance. At Wallack's, Daly's, the Bijou and Casino, the gas was lighted after a few minutes delay and there the performances were not delayed noticeably The orchestras played light music during the interval. The managers who telephoned the United Electric Light and Power Company learned that a main machine switchboard in the light station at Twenty-ninth street and the East River had been burned out. All lights were on again in twenty minutes or a half hour. Many of the electrical advertising signs along Broadway were darkened meanwhile. The lights in front of the Broadway Theatre were extinguished, but the theatre lights were not affected. Ten minutes before the curtain was to go down on the last act of "Chris and the Wonderful Lamp" at Hammerstein's Victoria the auditorium began to fill up with smoke. At first it was only a slight haze, but it grew thicker, until everybody noticed it. Policeman Baxter sent for fire engines. They came and brought a great crowd with them. Out of the side entrance of the theatre, into the midst of this crowd, three young women in skin-tight garments of brilliant green descended in wild disorder, yelling "Help! Help! Help!" Manager Ben Stevens was close after them. He caught two of them in the middle of Broadway and led them, tearful, back to the theatre, lecturing them on the impropriety of going abroad in their thin attire on such a cold night when Comstock agents were around. The third was not returned until later. She was found in the Hotel Metropole.

AUTOMOBILES

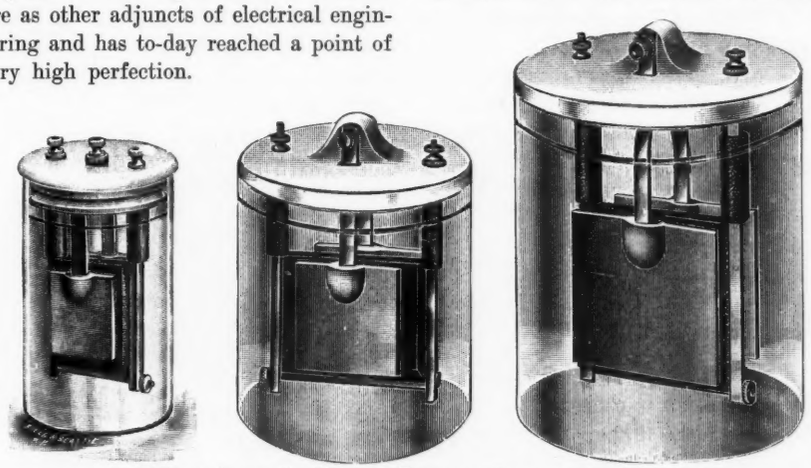
At a recent meeting of the Automobile Club of America it was decided to send a challenge for the International Automobile Cup, now held by the Automobile Club of France. The challenge, as sent, will not state names of any of the three competitors which will be allowed from each competing club. The race will not take place until next July.

A recent press despatch from Paris, states that the Automobile Club of France some months ago appointed a committee to ascertain who was the real inventor of the automobile. The committee now reports that M. Lenoir, who on January 24, 1860, took out a patent for a motor operated by the explosion of gas, is entitled to the honor. Lenoir, who is still alive and aged 78 years, was discovered in an obscure village. The Automobile Club is now organizing a big fete in his honor and will present to him a handsome gold medal.

Mr. Cyrus Field Judson, president of the General Carriage Company, is reported to have made the announcement that the company will very soon put into public service in New York 200 carriages and 100 omnibuses. The fare in the latter may be only three cents. The company was capitalized at $20,000,000 a few days ago. "The conveyances will be operated, some by electricity, others by air-power and still others by gasoline," Mr. Judson is reported to have said. "It is our intention to experiment with these systems, and which ever proves to be the most satisfactory we shall adopt entirely. Many of the carriages will be on public call; that is to say, they will be on public stands at different points throughout the city where they can be engaged as conveyances now or hired at public cab stands. Other carriages will be kept in stables and will be available for private calls, as carriages now are from livery stables. The omnibuses will run over different routes, one of which will probably be in Fifth avenue. These conveyances have been made at different factories, the greater part of them at Providence, R. I., and at Boston. We intend to enter into direct competition with the surface car systems and with the public conveyances operated by horses. We shall make a very low rate of fare, as we are enabled to do by our charter. The rate may be three cents on omnibuses, while the cab fare may be fixed at 25 cents a mile, but this point will be settled and made public within a day or two."

Modern Types of Primary Battery.

From the days of Alessendro Volta, who discovered the electric battery, to the present time, just one century has elapsed, and in it has been crowded the wonderful development of all varieties of electrical appliances. The electric battery has been developed in the same measure as other adjuncts of electrical engineering and has to-day reached a point of very high perfection.

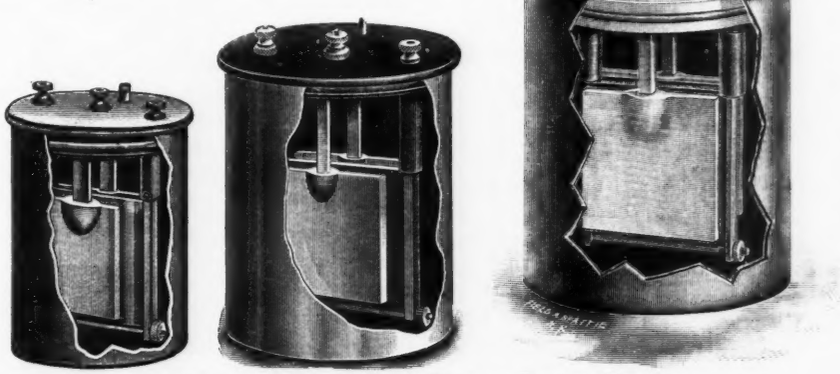


FIGS. 1, 2 AND 3.—MODERN TYPES OF PRIMARY BATTERY.

The first types of batteries were those employing a single fluid, but later they were superseded for the majority of practical applications by two-fluid batteries, an improvement that necessitated the use of a porous cup or else required one solution to be floated on the top of the other, thus necessitating the installation of the battery in some place where it would not be subjected to jarring or motion. It was also found out that the majority of fluids used in such batteries were liable to freeze in cold weather, resulting, naturally, in the destruction of the cell.

The type of battery here illustrated is of perhaps the most modern form and employs but a single fluid which is a solution of caustic potash. The two plates consist of zinc and black oxide of copper. This is obtained by roasting copper turnings in a stream of air and steam, and the resulting black oxide is then ground into powder and compressed into solid slabs or bricks from which plates of a suitable size for the different cells are cut. Porcelain jars are used, the copper oxide plates being suspended from the cover in a frame of grooved copper, while the zincs, which are rolled from this metal, are also fastened by bolts from knobs on the cover. By using this rigid mechanical fastening, the danger of short circuiting by the plates coming together is obviated and the use of separating pieces is rendered unnecessary. On top of the solution is floated a layer of heavy paraffine oil, which keeps out the air and prevents evaporation or the crystallization of the salts. The electro-motive force of such a cell is 0.95 volt, which falls to 0.7 volt when the cell is working on a closed circuit. While this appears low, the internal resistance of the cells is also very low. For example, one eight inches high by six inches in diameter has a total internal resistance of less than one-half ohm. Among the valuable features possessed by batteries of this type may be mentioned the absence of local action and that no noxious or poisonous fumes are given out while they are at work.

The illustrations show various types of these improved batteries as manufactured by the Edison Manufacturing Company, New York, for different uses. Fig. 1 has a capacity of 100 ampere-hours and is available for small gas engines, slot-



FIGS. 4, 5 AND 6.—MODERN TYPES OF PRIMARY BATTERY.

machines and such uses. Fig. 2 shows a cell in which two zinc plates are employed with one copper oxide plate, giving a total capacity of 150 ampere-hours. This cell is useful for gas engines, the operation of small fan motors, spark coils, large annunciators, burglar alarms, etc. In Fig. 3 is shown a cell having a capacity of 300 ampere-hours, and designed especially for phonograph motors, district and fire alarm telegraph purposes, local and main line batteries, electroplating and railroad and crossing signal bells. A special variety of cell is shown in Fig. 4, the peculiarity of this type being that it is made in a liquid-tight, enameled steel jar and is adapted for use in places where there is considerable motion, such as aboard vessels and yachts. The capacity of this element is the same as that of the small cell shown in Fig. 1. Fig. 5 represents a larger model of a similar type, this giving 150 ampere-hours capacity and being especially adapted for marine and traction engine purposes, automobile engine ignition, and as a portable engine for phonographs. Fig. 6 is a large cell made also in the enameled steel case and is adapted for the larger work in marine, automobile and portable installation. Its capacity is 300 ampere-hours.

A statement has been made by Gen. James Jourdan, President of the New Amsterdam Gas Company, of New York City, indicating that his company might also compete with the Consolidated Gas Company in the electrical field, the last-named company having acquired control of the New York Gas and Electric Light, Heat and Power Company. The New Amsterdam Company, General Jourdan stated, through owning the franchise of the East River Gas Company, is authorized to make and sell electricity as well as gas, and under a special act passed by the Legislature in 1892, is permitted to build its own conduits for wires. The existing subways, he said, could be used if necessary without any trouble, and experts have been at work drawing plans for the erection of an electric plant on the other side of the East River and the installation of electric wires over a large portion of the city.

COMMENTS ON OUR NEW YEAR DOUBLE NUMBER.

"MORE STYLE."

To the Editor of Electrical Review:

The Electrical Review in its present form has more style than any electrical journal published.

W. Rollins.

Boston, January 15, 1900.

"REFLECTS CREDIT."

To the Editor of Electrical Review:

Permit me to congratulate you on the appearance of the double number of the Electrical Review, which I received this morning. It certainly reflects credit upon its publishers.

De Veau & Company.

New York, January 10, 1900.

"A FINE NUMBER."

To the Editor of Electrical Review:

We are in receipt of the Electrical Review of January 3. Allow us to congratulate you on such a fine number. We think it is a great improvement.

Farr Telephone and Construction Supply Company,

C. W. Farr, President.

Chicago, January 12, 1900.

"FINEST."

To the Editor of Electrical Review:

I wish to congratulate you on your very handsome New Year's number. It is the finest thing of its kind I have seen for some time, and both the reading matter and advertising are worthy of special commendation.

E. M. Scribner.

Bridgeport, Ct., January 15, 1900.

A PLEASED ADVERTISER.

To the Editor of Electrical Review:

We have received your double New Year's number, and wish to congratulate you upon the improved appearance of your paper and the success of your enterprise. We are also very well pleased with the way in which you displayed our advertisement.

Arnold Electric Power Station Company.

Chicago, January 11, 1900.

PARTICIPATION EXCEEDS ANTICIPATION.

To the Editor of Electrical Review:

I have at hand the January 3 issue of the Electrical Review, and wish to express my great pleasure while perusing the many new features through the pages and in the general make-up. When you called at my office you aroused my anticipation by telling of some of the new plans, but I must say my participation far exceeds what I had expected. I know the Review will continue to hold its distinctive place in the electrical business.

Wishing you much success throughout the year, I remain,

John T. McRoy.

New York, January 10, 1900.

WELL-PLEASED ADVERTISER.

To the Editor of Electrical Review:

We have received your double New Year's number and wish to congratulate you upon the improved appearance of your paper, and the success of your enterprise. We are also well pleased with the way in which you displayed our advertisement.

Arnold Electric Power Station Company,

George A. Damon.

Chicago, January 11, 1900.

WILL AGAIN ADVERTISE.

To the Editor of Electrical Review:

The new form of the Electrical Review as issued under date of January 3, certainly reflects great credit upon the editor and his colleagues. As a matter of fact, the improvement was the means of inducing the writer to again use the columns of the Electrical Review. I am sure the change of form and appearance will add much to the attractiveness of the Review.

Charles M. Wilkins.

Philadelphia, January 15, 1900.

PERFECT FROM COVER TO COVER.

To the Editor of Electrical Review:

A copy of your issue of January 3 is before us, and it is indeed a grand improvement over the old form. We think you are to be congratulated for such excellent results in typographical arrangements and press work on the very first issue of the new form. There are so many things to be thought out in making a change of this kind that no matter how much care is given, perfection is seldom attained the first issue. This does not, however, seem to be the case with the Electrical Review New Year double number, for it is indeed perfect from cover to cover. Everything seems to be so clean-cut that anything but admiration is impossible.

Wishing you much success for the New Year, and believing that your efforts will be duly appreciated by electrical manufacturers and kindred interests, believe us,

Yours very truly,

Bullock Electric Manufacturing Co.,

Frank G. Bolles,

Advertising Manager.

Cincinnati, January 13, 1900.

"MOST AUSPICIOUSLY."

[*Chicago Evening Post.*]

The Electrical Review has begun its nineteenth year of publication most auspiciously.

"GREATLY PRAISED."

[*Niagara Falls Press.*]

The Electrical Review for New Years is a superb double number and greatly praised at this centre of electric developments.

"REMARKABLE."

[*Lowell Citizen.*]

The Electrical Review, New York city, begins the New Year with a special double number which is remarkable for its valuable contributions, handsome illustrations and typography. A new dress of type, a change in the color of the cover and a more up-to-date arrangement of reading pages are some of the improvements made.

ELECTRICAL PROGRESS HERE AND ABROAD.

[*Hartf rd Courant.*]

The Electrical Review for January 3, is a new year "double number." It contains articles on electrical progress, during 1899, in this country and abroad, and much other matter of interest. In this issue appears the first of George C. Maynard's papers on "The Electrical Collections in the Smithsonian Institution and the National Museum."

NEW COVER, NEW TYPE, NEW FORM.

[*New York Press.*]

The Electrical Review celebrates the new year with a new color of cover, a new arrangement of reading matter and a new dress of type, besides appearing in a more convenient form. Among the articles in the January number is one by S. Dana Greene—who was drowned recently—giving an account of the progress of the General Electric Company in the last year.

THE FIELD COVERED.

[*New York World.*]

The electrical progress of the past year and the prospect of the continued advance of electrical science during the coming year are reflected in the double number of the Electrical Review of January 3. Improvements in typography, cover and other material features are noticeable, but are less important than the notable addition to the features of its contents, in which the whole field of electrical industry is fully laid before the reader.

The Publication of Catalogues.

To the Editor of Electrical Review:

In connection with my work as editor of the "National Cyclopædia of Mechanics," I have, from time to time, addressed letters to most of the principal manufacturing concerns of this country and Europe, asking them to send me any matter, in the way of circulars, catalogues, etc., which they may have issued, descriptive of their manufactures. A comparatively small number of such manufacturers showed any very considerable interest in the subject, sent me blue prints, drawings, catalogues, and offered every facility at their command. A large number of manufacturers sent me their catalogues; and a certain number wrote me that they "were not interested" or "had no time to devote to the subject."

It was of interest for me to note that those concerns who offered to do the most were old-established, well-known firms, while those who had "no interest in the subject," or "were too busy," were invariably mushrooms in the field of industry.

As a result of the various letters sent out by me, I have collected a large number of catalogues; and, in looking them over, I note: First, that they range in size from 14 by 16 to 3 by 4 inches; and, strangely enough, the manufacturers of the largest machines employ the smallest size of catalogue. Second, that such catalogues consist of a series of engravings, more or less poorly executed, accompanied by text, which, in the most of them, is merely fulsome praise of the machines shown; of the balance, many contain poor descriptions of mechanism, without any description of operation, while a very few contain intelligent descriptions of both construction and operation, and by intelligent descriptions, I mean such descriptions as a person desiring information relative to the construction and operative features of the machine shown would like to find. Third, that a majority of these catalogues contain tables of sizes, etc., unaccompanied by any explanation whatever, which makes such tables intelligible to any one not possessing an advanced engineering education. Further, that many contain tables, I assume for the information of the reader, taken from old and antiquated text books, and which are not at all adapted to modern practice. Fourth, taken as a whole, that the trade catalogues of Europe are better than those of America.

In my opinion, the interests of the American manufacturer will be promoted, especially in the direction of foreign trade, if more attention is paid to the subject of catalogue making. To facilitate the preservation of catalogues, they should be all of the same size; preferably 6 by 9. The illustrations should be pictures, preferably views in perspective, and only such as is sufficient to convey to the eye the general appearance of the machine. A poor illustration makes a bad impression. Too much detail, especially where reduced working drawings are used, acts to the disadvantage of the manufacturer. I have frequently known reduced working drawings to be employed as a basis for designing infringing machines. The descriptive matter should set forth the general features of construction and operation of the machines, and especially the points of superiority over other machines in the market, but without mentioning the names of other machines. All extravagant praise of the machines shown should be avoided. No one believes it. Tables of sizes, accompanied by an ordering index, should be used. If the compiler of the catalogue has a desire to insert tables, he should suppress it, and merely indicate by a few notes the well-known text books where such tables can be found.

Catalogues intended for use in expositions in foreign countries should always be translated. It is a waste of money to distribute catalogues in foreign countries printed in English. Where catalogues are intended for distribution in Asiatic countries, care should be taken to select a cover which in color is not antagonistic to the prejudices of the inhabitants of the country. Red is the best color to use; black, green and yellow should be avoided.

The text and pictures of all catalogues should be copyrighted in every country where they are to be distributed.

Geo. H. Benjamin.

New York, January 23, 1900.

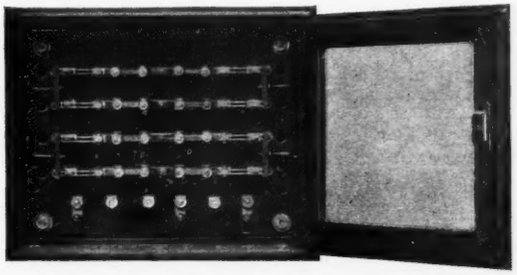


Fig. 1.—Standard Junction Box.

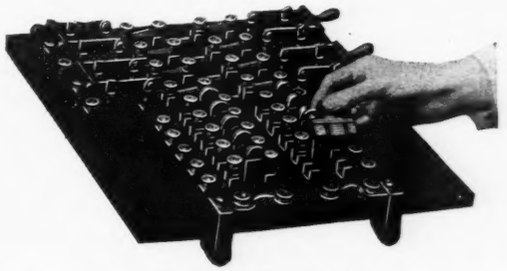


Fig. 2.—A Tablet Board.

Fig. 3.—Inserting a Detachable Fuse-Holder

Some New Types of House-Wiring Fittings.

The tendency of American manufacturers has always been notably in the direction of producing standards in manufactured goods, especially in the case of electrical adjuncts and appliances. The illustrations shown herewith represent new types of tablet boards and fuse accessories which possess numerous features of novelty and merit. Fig. 1 shows a standard junction box for three-wire mains containing a four-circuit tablet board with two-wire branch knife-switches. Fig. 2 illustrates a tablet board removed from its containing box, and shows not only the arrangement of connections but also the application of the detachable fuse-holder which is shown more in detail in Fig. 3. It is seen from this that a fuse may be inserted in this holder without the use of other tools than those which nature provides, and that at the same time the fuse is protected and ventilated, while there is no danger of a burn resulting in the handling of the fuse should the circuit in which it is placed be closed. A peculiar advantage of the detachable tablet board is that it may be put in place in a wall box or other situation in a building after all the rest of the wiring is completed. This prevents any possibility of damage to the finished parts during the process of installation. These goods are manufactured by Messrs. Johnson & Morton, of Utica, N. Y., who are also large producers of other varieties of electrical fittings.

Enlargement of the Electric Light Plant at Manila, P. I.*

The Electric Light Company, of this city, says the Manila *Times*, have entered into a contract with Messrs. Bagnall & Hilles, the well-known electrical engineers and contractors, for the supply of all the machinery and apparatus, including dynamos, switchboards, engines, boilers, condensers and all other necessary material for the extension of their electric lighting system here in Manila. All the machinery for the complete plant will be manufactured in the United States, and when the installation is completed the Electric Light Company will have doubled their present capacity for incandescent lighting, besides adding to their arc lighting system.

The machinery to be supplied by Messrs. Bagnall & Hilles will consist of two dynamos to be used for incandescent lighting, each dynamo having a capacity of 6,000 lamps of 16 candle-power, making a total of 12,000 additional lamps, one arc lighting dynamo with a capacity of 85 arc lamps of 2,000 candle-power each, two automatic cut-off cross-compound condensing engines, 500 horsepower each, with two surface condensers and four water tube boilers of 250 horsepower each, etc. All the machinery will be of the most modern design, and the people of Manila can expect an electric light service equal to any in the world.

No enterprise on these islands has a better reputation than the Electric Light Company, of Manila. Their service has always been good, and their lights both in the houses and throughout the streets have always given the very best of satisfaction, the lights having been operated without a single interruption since the system was handed over to the company in complete working order nearly five years ago. Even during the late troubles and blockading of Manila the electric lighting system was the one important thing that the public depended upon, and during those trying times the electric lights never failed to serve the anxious public for one single moment. This speaks well for the enterprising management of the company, and also for the firm of Bagnall & Hilles, who supplied and installed the plant, and the public of Manila will show their appreciation of the faithful and splendid service rendered by supporting the company in the future as they have in the past.

The new machinery will be shipped from America at once and will be installed under the personal supervision of the contractors.

* This plant was illustrated and described in the ELECTRICAL REVIEW for March 22, 1899.

The Oldest Enclosed Fuse.

The present discussion by the Board of Fire Underwriters about enclosed fuses, calls attention to what is probably the oldest as well as the most widely-used fusing device, utilizing the enclosed fuse principle—the Edison plug cutout. This device has now been in constant demand for almost twenty years wherever 125-volt circuits are installed.

In 1881 the first cutouts of this type were constructed and used in all of the early installations of the Edison lighting systems, notably the large lighting plants in New York, Boston and Milan. The fuse plug was patented in the following year in its original form, but in 1885 a number of improvements were added, and as then patented its external appearance was substantially that which has been used ever since.

The body of the plug was first made of wood with a suitable enclosure for the fuse, later it was made of glass with a metal screw cap. It has however from the first embodied the convenient screw feature which has distinguished the Edison base lamps for so many years.

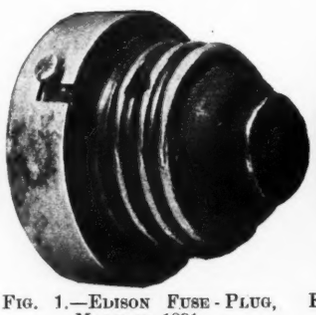


FIG. 1.—EDISON FUSE-PLUG, MADE IN 1881.

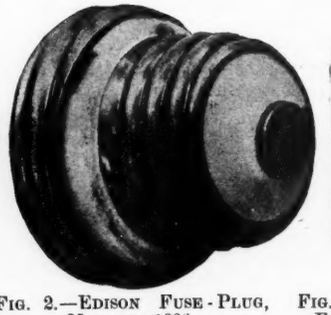


FIG. 2.—EDISON FUSE-PLUG, MADE IN 1900.

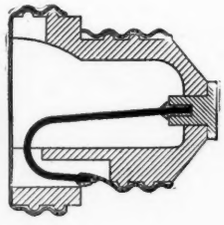


FIG. 3.—SECTIONAL VIEW OF EDISON 1900 FUSE-PLUG.

In 1896 these fuse-plugs were still further improved, the glass body being changed to porcelain, and its internal construction being modified to permit the use of a longer fuse which passes over a barrier and secures a much higher efficiency.

During the early introduction of electric lighting, hundreds of thousands of these cutouts were shipped to all parts of the world, many large systems being fully equipped with them.

The introduction of electricity into houses was at first regarded with considerable apprehension by tenants and property owners, hence the simplicity of the screw plug fuse appealed at once to every one interested. By its means a man entirely ignorant of electricity or mechanics could renew a fuse without any danger either to the circuit or himself, and when the fuse melted no sparks escaped from the plug to endanger surrounding objects.

Probably no other device at present used in electric installations has for so many years so adequately fulfilled the purpose for which it was originally designed, with but slight modifications. In its present form, as patented in 1896, it is one of the most popular and most generally approved devices for protecting 125-volt circuits.

A Large New Electrical Enterprise.

A certificate of incorporation was filed a few days ago with the Secretary of State of New Jersey by the Stanley Electric Manufacturing Company, with an authorized capitalization of $2,000,000. The stock is to be divided into shares of the value of $100 each, and the incorporators named in the certificate are Frank O. Briggs, John H. Janeway, Jr., W. H. Gandy, Louis C. Taylor, Edward W. Taylor, William A. Anderson and Duncan Anderson, all of this city, and each of whom holds five shares of the stock. All are connected with the John A. Roebling's Sons Company. The new corporation is organized to take over the property of the Stanley Electric Manufacturing Company, of Pittsfield, Mass. It is understood that the Roeblings own a large majority of the stock, and they, together with Governor Crane, of Massachusetts, the active staff of the company, and several parties who are large users of electrical apparatus, will provide the full amount of the capital stock required for the purpose of building large shops at Pittsfield and greatly extending the business of the company. The Pittsfield Company has been a very successful one, growing from a small shop originally only intended for experimental purposes. The alternating-current apparatus now built by the Pittsfield Company bears a high reputation, and is used in this country and abroad especially for hydraulic power electric transmission.

The London (England) County Council has decided to install an underground electric trolley system after American plans and using American cars. The cost will be $15,000,000, and the fares two and three cents.

INDUSTRIAL NOTES

N. W. Ayer & Son, Philadelphia, the newspaper advertising agents, have issued a tasteful wall calendar of convenient size.

The Colonial Electric Company, Youngstown, Ohio, is sending out a handsome calendar in colors, advertising the Colonial incandescent lamp.

The Wagner Glass Works, 213 East Nineteenth Street, New York, manufactures superior incandescent lamp bulbs and glass tubing for electrical purposes.

The Hardy Lamp Company, Pittsfield, Mass., manufacturers of incandescent lamps, has introduced a system of replacing incandescent lamps that has proved satisfactory.

The cumulative suasion of one satisfied patron carries its influence to another. The Gutmann wattmeter sales increased double last month. So say the Electric Appliance Company, Chicago.

M. I. Vought, La Crosse, Wis., manufactures a most practical "two-ball" adjuster for incandescent lamps. It is possible, by using the contrivance, to place the lamp exactly where it is wanted—up, down and side-wise.

The Fort Wayne Electric Works, Fort Wayne, Ind., has issued a new catalogue, illustrating and describing parts of Wood open arc lamps and "Sure Grip" pulleys. The catalogue is No. 2002 and may be had for the asking.

The Warren Electrical & Specialty Company, Warren, Ohio, has issued a beautiful calendar printed in colors, advertising the "Peerless" incandescent lamps, direct-current fan motors, and transformers. It is one of the most artistic calendars of the season.

The Automatic Switch Company, Baltimore, Md., will send circulars and descriptive matter relative to its different makes of auto-starters manufactured under the Whittingham patents. These starters are adaptable for direct connection to hoists, elevators, or any service requiring a rapid start, stop and reversal of the motive power.

The Eureka Electric Company, of Chicago, are sending out gratis, a beautiful small lapel telephone emblem button. The design used is the adopted design of several states of the Independent Telephone Associations, and is a very handsome button. The Eureka Company are scattering these gratis, and will be pleased to mail one to any company in the field, desiring it.

The new factory of the Speer Carbon Company, at St. Mary's, Pa., is now equipped with the greater part of the new carbon machinery which has been under special construction, and the company are meeting with excellent success in the introduction of their new brands of carbons, particularly the Speer self-lubricating motor brush. The company are also making carbon points for both open and enclosed arc lamps.

The National Automatic Telephone Company, of 71-75 West Jackson Boulevard, Chicago, is at the front with a full line of instruments pertaining to telephone equipment. This company has been doing an extensive business for more than two years, and claims to have entirely mastered the problem of automatic communication. The recent improvements make up a line of instruments that covers the field. The company's automatic exchanges are numerous, and speak for themselves. The company is now in position to furnish long-distance controlling instruments for toll-lines, also for party lines, complete equipment for interior systems, all entirely automatic. The advantages claimed for these instruments are many, among which may be mentioned, cost of construction, simplicity, the greatly reduced cost of maintenance, rent, fuel, light, operators, etc., and absolute guarantee of the company. Mr. F. A. Lundquist, superintendent of the National Automatic Telephone Company, of Chicago, is now in St. Louis on important business matters connected with his company.

Rubber in Mexico.

In answer to a request for information, Vice-Consul-General Hardy writes from Mexico, December 26, 1899:

Land, suited to the growth of rubber, can be had anywhere from $1 to $15 per acre. The titles will be found vested in private ownership; none are in the government. The land will, in all cases, be a dense jungle. Cacao, pineapples and bananas can be grown as well as rubber. Prairie or grass land is not adopted to this product.

Rubber may be planted from branch cuttings, root cuttings and from trees grown in the nursery from seeds. From 150 to 300 trees are set to the acre, and they are tapped anywhere from five to fifteen years after planting, according to the locality.

Under the most favorable conditions a tree will yield an average of one to two pounds of rubber. The present market price at Frontera is $1.44 Mexican (about 67 cents in United States currency) per pound. The tree is long-lived, and the production increases with age. No machinery is required for handling the gum.

The rubber plantations of Mexico, as a rule, are remote from centres of population; they are always thinly inhabited. Oriental labor must be imported. The approximate wage is $1 silver (47 cents gold) per day. Knowledge of the language of the country is desirable for a person about to engage in the cultivation of rubber.

As to the comparative cost of living in the United States and Mexico, I will say that if a man is content to live in Mexico as the natives live, he can exist very cheaply; but if he desires to live here in the manner to which he is accustomed in the United States—eat the same food, prepared in the same way—it will cost him a great deal more than at home.

The rubber tree of Mexico is found growing from the Guatemalan boundary as far north as Tuxpan on the Gulf coast, and as far north as Colina on the Pacific coast. The maturity of the tree and its production are measured by the quantity and uniform distribution of the rainfall, together with high temperature throughout the year. In low altitudes, localities of 150 and 200 inches of rainfall distributed over eight or ten months in the year enjoy the best conditions, although rubber does grow where they have six months of rain and six months of dry weather; but, in these localities, it requires from 12 to 15 years for the tree to mature, while in districts with an ample rainfall it will flower within five or six years.

Federal Salt.

The *Southern Trade Record*, of December 18, in reply to a number of inquiries, speaks as follows of the product of the Federal Battery Company, of New York city:

To explain to those readers of the *Record* who are not conversant with its policy, we will explain why this investigation is made. The *Record* acts as a commercial agency, and makes similar reports on the practicability, reliability and worth of anything manufactured, the same as a mercantile agency reports on the financial standing of firm or individual. The *Record* has never made an unreliable indorsement in all the years it has been published.

"Federalite" is manufactured by the Federal Battery Company, of 11 Pine street, New York. This investigation demonstrated the fact that this preparation gives more current, will last longer, and is much cheaper than sal-ammoniac, and it can be used with equal benefits in any kind of battery.

The company also manufacture Federal salt, which is somewhat stronger than "Federalite," and is packed in neat paper boxes, containing a charge for the battery.

The Federal Battery Company are thoroughly reliable, and they have a high commercial standing.

The General Electric Company will break ground within two weeks for what, it is asserted, will be the largest office building for a manufacturing business in the world. The building will be near the main entrance to the Schenectady works, and is to be used solely for the general offices of the company, the business of which has long since outgrown the present accommodations available. It will be 150 by 250 feet, and the height will be five stories.

ADVANCE INFORMATION

Electric Light and Power.

NEW BRIGHTON, N. Y.—The New Brighton Electric Light, Heat and Power Company, of Staten Island, has been incorporated. The company intends to furnish heat, light and power for public and private uses. Its capital stock is $1,000. The directors are William Irving, John Irving and George Irving, of New Brighton. The Messrs. Irving have been supplying a number of New Brighton business men for some time.

COLUMBUS, GA.—At a meeting of the stockholders of the Columbus Power Company, held recently in Savannah, it was decided to increase the capital stock from $200,000 to $300,000 and it was accordingly done, the stock being at once taken up by subscription.

BRISTOL, N. H.—The Bristol Electric Light Company has increased its capital stock $8,000. A 100-kilowatt direct-current generator will be purchased.

LISBON, N. H.—The Lisbon Electric Light Company and the Lisbon Power Company have been consolidated and a new company organized with a capital stock of $30,000.

HARTFORD, CT.—On recommendation of the directors of the Hartford Electric Light Company, the capital stock will be increased from $700,000 to $1,000,000. The new stock will be allotted at par to old stockholders and will be used to pay for the new power developed at the Farmington River, and a new storage battery at the Pearl street plant which will be used for other purposes. There are $150,000 of six per cent first mortgage bonds of Hartford Light and Power Company which it has guaranteed, that are subject to call at any time and which may be retired.

ALLIANCE, NEB.—This town will soon install an electric lighting plant.

CHARLESTOWN, W. VA.—The plant and lines of the Charlestown Electric Light, Heat and Power Company have been sold at public auction to the trustees of the estate of C. E. Ebrehart, of Hanover, Pa. The sale was made to pay mortgages and settle the Ebrehart estate. The price paid was $10,150.

ASBURY PARK, N. J.—A new electric lighting plant is contemplated at Asbury Park, N. J., by the authorities of that place. It will be equipped with three engines and three dynamos of seventy lights' capacity; one additional boiler of 200 horse-power will also be required, in addition to the building, which will be brick and iron. Cost, $25,000.

CEDAR RAPIDS, IOWA—The Cedar Electric Light and Power Company has filed amendments to its articles of incorporation increasing the stock from $350,000 to $500,000. C. J. Ives, J. H. Smith, W. G. Dows, W. D. Douglas and W. J. Greene are the directors.

DAYTON, OHIO—The Dayton Electric Light Company has organized with the selection of the following directors: W. D. McKemy, R. N. King, H. C. Kiefaber, R. M. Nevin, J. C. Reber, T. J. Weakley, E. Bimm and Dr. J. E. Lowes. The officers are: President, Dr. J. E. Lowes; vice-president, R. N. King; secretary, H. C. Kiefaber; treasurer, J. C. Reber.

FREEPORT, ILL. — W. H. Wheeler, owner of the Freeport water-works, is offering to put in a great electric power plant to furnish electric power for manufacturing institutions for lighting and for other purposes.

READING, PA. — The Berks Electric Light, Heat and Power Company has been organized here with these officers: President, Daniel B. Shepp, Philadelphia; secretary, H. M. Albright; treasurer, John H. Printz, the last two of this city. The company will bid for the lighting of the streets of this city.

WASHINGTON, IND.—The Washington Light and Power Company, of Washington; capital stock, $21,000; directors: Robert A. Brown, A. J. Padgett, Henry M. Geiger and M. F. Burke.

FOWLER, IND.—Fowler Electric Company; operate electric light plant; capital, $25,000; incorporators: C. C. Curtis, H. B. Mersh, E. M. Campbell, J. W. Noel, all of Fowler.

ST. PAUL, MINN.—The Owatonna Light, Heat and Power Company has been granted a franchise to build a plant at Owatonna, Minn., and will furnish gas, heat and electric lights in that city.

Electric Railways.

SOUTHINGTON, CT.—The Connecticut Lighting and Power Company has bought of the Southington & Plantsville Tramway Company all of the latter's property and assets, as a result of a special meeting of stockholders. The meeting elected J. E. Sewell, H. W. Minor and G. E. Perry, of Waterbury, and E. H. Mather, of New Britain, directors, to fill vacancies caused by the resignation of L. K. Curtis, E. G. Lewis, J. F. Pratt and Stephen Walkley, of this place.

YORK, PA.—The York Traction Company has been organized by Judge W. F. Bay Stewart, Captain William H. Lanius, president of the York extension of the Western Maryland Railroad; William A. Himes, of New Oxford, Pa.; Grier Hersh, president of the York National Bank; John W. Steacy, George P. Snyser and George S. Billmeyer. The new company has purchased the York Electric Railroad and will build extensions to Dover, Weiglestown, Dallastown, Norway Park, and other points in York County.

CHATTANOOGA, TENN.—The stockholders have authorized an issue of $100,000 additional bonds for the purpose of extending and equipping the Rapid Transit Electric Railway from Chattanooga to Chickamauga Park.

BROOKLYN, N. Y.—South Brooklyn Railway Company. Capital, $150,000; incorporators: W. B. Cutting, J. F. Ambrose, J. A. Murray, all of New York city; D. Ward, of Irvington.

HAMPTON, VA.—A company has been organized under the title of the Hampton Roads Railway and Electric Company to build a road from Newport News to Hampton and other points. The company will also build a plant to furnish electric power and lights.

TOLEDO, OHIO—The Toledo & Bay Point Electric Railway Company will build a monorail road to Bay Point nine miles from the city, on Lake Erie. They will erect a Summer hotel and theatre there at a cost of $250,000.

Miscellaneous.

WILMINGTON, DEL.—National Electric Appliance Company. Capital, $50,000; incorporators: E. R. Hunt, H. Bryant, W. W. Smithers, all of Philadelphia.

SEATTLE, WASH.—Seattle Electric Company. Capital, $6,250,000; incorporators: Jacob Furth, M. McMicken, T. Burke, C. J. Smith, R. V. Ankeny, all of Seattle.

CHICAGO, ILL.—Morgan Electrical Machine Company, manufacturing electrical goods. Capital, $25,000; incorporators: E. C. Morgan, D. B. Douglas, J. H. Barnard, all of Chicago.

DANVERS, MASS.—Neal A. Moynahan and Frank E. Moynahan have formed the Consolidated Electric Lamp Company, for the renewing of burned out incandescent lamps.

CORIMANS, N. Y.—The Corimans Electric Company. Capital, $50,000; directors: Willard F. Inman and John W. Drake, of New York city; John F. Montignani, of Albany, and Levi E. Conyes and Charles L. Diston, of Ravena.

NEW YORK CITY.—Schnee Russell Syndicate. Electric apparatus. Capital, $25,000; incorporators: W. T. Etgen, of Dongan Hills; F. L. Campbell, of Brooklyn; J. V. B. Merritt, of New York city.

Telephone and Telegraph.

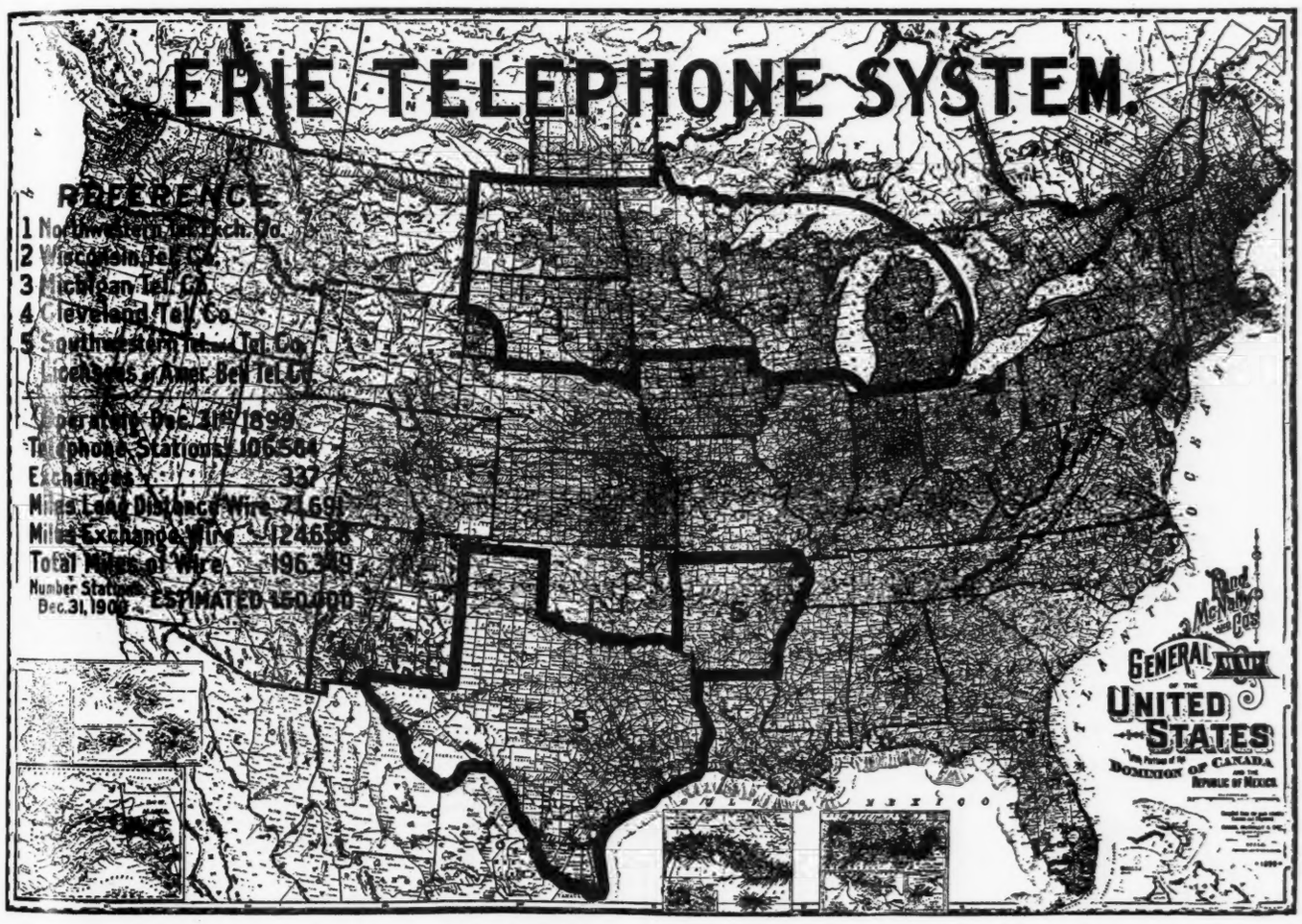
TROY, N. Y.—The Troy Telephone Company, increase of capital stock from $10,000 to $40,000.

ALBANY, N. Y.—The Black River Telephone Company has been incorporated. Its general route is to be from Watertown to Utica, connecting as principal points Carthage, Lowville, Boonville and Rome, and as minor points the villages of Delta, Lee, Lee Centre, West Branch, Ava Corners, West Sydney, Mohawk Hill, Bryon's Corners, Constableville, Turin, Port Leyden, Leyden, Lyons Falls, Houseville and Martinsburg. The capital stock is $25,000, of which $5,000 is to be preferred stock, entitled to six per cent annual dividends. The directors of the company for the first year are John J. Domser and Philip Domser, of Lewis, Lewis County; Fred C. Myers, of Sylvester, C. Caypron and Benedict Gantner, of Leyden, Lewis County; Homer C. Markham, of Lyons Falls, David Swancott and Frank Harrington, of Lee.

MAP OF THE TERRITORY COVERED BY

THE ERIE TELEPHONE AND TELEGRAPH CO.,

LOWELL, MASS.


ERIE TELEPHONE SYSTEM.
REFERENCE
1 Northwestern Tel. Exch. Co.
2 Wisconsin Tel. Co.
3 Michigan Tel. Co.
4 Cleveland Tel. Co.
5 Southwestern Tel. Tel. Co.
Lines of Amer. Bell Tel. Co.
Operated Dec. 31st 1899
Telephone Stations 106504
Exchanges 337
Miles Long Distance Wire 7169
Miles Exchange Wire 124656
Total Miles of Wire 196349
Number Stations Dec. 31, 1900 ESTIMATED 150,000
Rand McNally and Co's
GENERAL MAP OF THE UNITED STATES
DOMINION OF CANADA
REPUBLIC OF MEXICO

The above illustration gives a good idea of the vast territory controlled by the Erie Company.

The Lowell *Mail*, of January 17, in its despatches from Detroit, Mich., says:

> "A gigantic telephone consolidation was consumated here to-day. Ten thousand independent telephone subscribers located in forty-six cities in Michigan, including Detroit, six thousand miles of independent long-distance lines, one hundred and sixty long-distance stations, the hub of the independent telephone business of the country, and fully seventy per cent of the entire independent telephone business of the state of Michigan passed into the hands of a new management, in sympathy with the managers of the Bell system, known here as the Michigan Telephone Company. The independent telephone companies concerned are the Detroit Telephone Company of this city and the new state telephone company, known as the Independent Long-Distance Exchange Company.
>
> "Closing negotiations in this consolidation is considered a master stroke on the part of President Glidden of the Erie system, and it is believed to be one beginning of the end of the independent telephone movement."

ELECTRICAL PATENTS

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED JANUARY 9, 1900.

640,760 Inductor dynamo-electric machine; H. Geisenhoner, Schenectady, N. Y.—An inductor having radial pole-pieces, a light, hollow, non-magnetic cooling structure secured to the inductor, and filling the spaces between the pole-pieces to present with the latter a cylindrical surface.

640,787 Device for indicating condition of storage batteries; H. P. Maxim, Hartford, Ct.

640,823 Telephone; R. F. Smith, Chicago, Ill.

640,873 Fire-alarm system and apparatus; L. Campbell, Washington, D. C.

640,959 Section insulator; J. A. Schumaker, Hartford, Ct.

640,968 Electric Vehicle; E. A. Sperry, Cleveland, Ohio—A vehicle body, a seat on the upper part of the body, with a plurality of battery-supports superimposed within the body and a plurality of groups of batteries upon such supports.

640,988 Telephone system; J. R. Blinck, Jersey City, N. J.

641,005 Telephony; S. B. Fowler, Tarrytown, N. Y.—A telephone system having the secondary of the induction-coil bridged across the line and the primary in series on the line, whereby the induced current is divided at the connection of the secondary with the line, one portion flowing in one direction over the line and the other portion in the other direction.

641,011 Battery; G. Heidel, St. Louis, Mo.

641,012 Brush for dynamo-electric machines; G. Heidel, St. Louis, Mo.—A negative brush for dynamos or electric motors composed of aluminum.

641,021 Electrical soldering iron; R. Kuhn, New York, N. Y.

641,051 Electrical measuring instrument; J. F. Stevens, Philadelphia, Pa.

641,076 Combined rheostat and attachment-plug; L. D. Carter, Louisville, Ky.

641,117 Stopping device for engines; J. J. Kaye, Newburg, N. Y.

641,125 Electric motor; H. Leitner, London, England.

641,140 Electricity-meter; C. E. O'Keenan, Paris, France.

641,147 Apparatus for magnetically separating ores; C. Q. Payne, Stamford, Ct.—A magnetic separator provided with two opposing magnetic surfaces, connections forming two magnetic circuits whereby a single magnetic field may be formed in the air-gap between the two surfaces, and means for producing line dispersion of the flux density within said field.

641,148 Method of magnetically separating ores; C. Q. Payne, New York, N. Y.

641,157 Switch for electric motors; O. F. Shepard, Jr., Medina, Ohio.

641,161 Earthing device for electrical circuits; L. J. Steele, London, England.

641,196 Electric lamp; C. Van Deventer, New York, N. Y.

641,214 Thermo-electrical building bricks; J. Mathias, Stuttgart, Germany.

641,220 Apparatus for magnetically separating ores; C. Q. Payne, Stamford, Ct.

641,224 Electric street-indicator; J. Y. Porter, Detroit, Mich.

ISSUED JANUARY 16, 1900.

641,257 Electrical controlling device; H. P. Ball, New York, N. Y.

641,264 Contact-box for electric tramways; E. Bonnet, Jules Paufique, Lyons, France—In a contact-box in which the current is taken from plugs level with the surface of the road by means of a magnetized bar, the combination of an air-tight box with an air-tight elastic chamber communicating with the box and maintaining an equilibrium between the interior and the exterior pressure.

641,275 Motorman's recorder; J. R. Cravath, Chicago, Ill.—An electric motor, a controller for said motor, means whereby the maximum possible rate of turning on said controller is kept within a predetermined limit, and a device or devices operated by the turning off or on of said controller, said device or devices adapted to record the number of revolutions said motor operates with current on.

641,276 Porous diaphragm for cells employing fused electrolytes; J. D. Darling, Philadelphia, Pa.

641,290 Pressure-regulating apparatus for mains; J. S. Highfield, St. Helens, England—A motor, an exciting-dynamo and a generating dynamo or booster, all having their armatures on one shaft, the exciter being arranged so that its currents oppose those from the source of energy and excite the field magnet of the booster which has its armature-coils in the lead from the source to the circuit.

641,302 Illuminated gauge; F. Lane, Brookline, Mass.

641,306 Electric water-heater; A. W. Lawton, New York, N. Y.

641,309 Coin-controlled electric battery; A. Linick, Chicago, Ill.

641,322 Method of regulating electric circuits; M. Pfatischer, Philadelphia, Pa.

641,335 Galvanic bandage; P. L. Schmidt, Worms, Germany.

641,360 Electric amalgamator; L. H. Barricks, San Francisco, Cal.

641,373 Telephone switchboard; F. B. Cook, Chicago, Ill.—A spring-jack switch and connections therefor, comprising a main contact strip and a supplemental contact-strip of relative different dimensions, together with plugs of different relative dimensions, one of which is of such dimensions that when inserted it makes contact with the main strip only and the other plug of such dimensions as to make contact with the supplemental strip.

641,374 Combined terminal head and junction-box; F. B. Cook, Chicago, Ill.—A combined terminal and junction-box, comprising a containing-shell, a cover therefor, a plurality of holding-heads in the said containing-shell and conducting arms or rods in said holding-heads together with an outer cover disposed over said containing-shell and holding-heads.

641,382 Electric lock; Levi Goughenour, Braddock, Pa.

641,396 Instrument for recording course and speed of vessels; Albert De Laski, New York, N. Y.—Consists of a surface adapted to receive a record, a magnetic needle for moving said surface, and means for tracing said record upon said surface.

641,400 Connection-counter for telephone-lines; F. R. McBerty, Downer's Grove, Ill.

641,412 System of electric circuits and brakes for vehicles; E. Sperry, Cleveland, Ohio.

641,425 Microphone; J. O. Zwarg, Freiberg, Germany.

PATENTS.

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Correspondence and interviews solicited.

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